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EDITORIAL

The publication of *Scientific Agriculture* in the present form marks an important step on the part of the Canadian Society of Technical Agriculturists, and one which should ensure the permanence of the magazine as a vital part of the Society's work. The transfer of ownership from the former publishers to the C. S. T. A. should give the members of the Society a closer personal interest in their official organ, since ownership implies responsibility in the success or failure of any enterprise. Ownership also provides complete direction and control of policy and in that sense, too, the change will permit of full consideration of the members' wishes.

The change in the management of the magazine was neither sought nor expected by the Society. A suspension of publication was forced upon the former publishers by prolonged industrial depression and steadily decreasing revenue. The burden could not be maintained longer by a commercial institution; it was necessary to curtail operating expenses in every possible way, and to continue the publication of only such magazines as were, at least, meeting the cost of production. *Scientific Agriculture* was not among these.

In taking over the magazine during such a period, and resuming publication, it will be realized that the Society assumed a particularly heavy responsibility. It appeared almost certain, however, that without an official organ, much of its usefulness would be lost; its progress would be handicapped and the interest of many of its members sustained only with difficulty. These conditions demanded the continuance of *Scientific Agriculture*. It was also believed that, under Society ownership and control, the members of the organization would all assume a share of the responsibility and give such personal assistance as would justify the confident attitude assumed by the Executive of the Society.

A number of changes have been made, not only in the size of the magazine but also in some of the features connected with its editorial policy and direction. These changes will, we believe, meet with the approval of all those receiving the magazine. The financial considerations involved in the ownership of *Scientific Agriculture* and therefore in the future conduct of the Society's operations, made it necessary to suspend publication from the end of June until the present time. In the interim all details connected with the transfer have been satisfactorily adjusted, considerable effort has been made to formulate an advertising policy and to bring the magazine to the attention of firms and institutions who have something to offer to progressive agriculture, and consideration has been given to ways and means of increasing circulation and conducting the more commercial lines of work involved.

In future the magazine will be published during the last week of the month *preceding* date of issue, the present issue (September) appearing at the end of August. Volume II will therefore contain only four numbers — September, October, November and December.

The reduction in the page size has been made at the request of many of our subscribers and members. The former size was not suitable for binding or filing, and was an inconvenient size for the printing of separates. The present size conforms closely to that of practically all technical or scientific journals, which is another feature distinctly in its favour.

The Editorial Board, announced in this issue will, it is hoped, function to the fullest possible extent in the near future, and thus ensure a permanent or constant supply of suitable material. Otherwise there will be great difficulty in maintaining the standard that has already been established.

The Canadian Society of Technical Agriculturists, as the owners of *Scientific Agriculture*, now assumes the full responsibility for its success or failure. In addition to the conduct of its educational programme, the operations of its branches and the consideration of problems and conditions confronting its members, it must now enter the commercial field and at least produce suf-

ficient revenue from its official organ to cover the cost of publication. In other words the magazine must be self-supporting and not be a financial burden carried by the Society.

In assuming this added responsibility at the height of an industrial depression, the Executive of the Society felt convinced that the magazine was supplementing, in a much needed manner, the periodical literature already reaching the agriculturists of Canada, and also believed that an official organ was vital to the Society. It is the link that binds the members and branches together; it is the only medium through which the work of the Society can be brought to the attention of progressive agriculturists and co-workers throughout the Dominion; and it furnishes a place in which research workers and men foremost in Canadian agricultural administration, extension, etc., can give expression to their views and publish the results of their work. Having these considerations in mind, and knowing that the personal co-operation and direct interest of every member could be depended upon, the conclusion drawn was that the circulation of the magazine would rapidly increase among non-members.

To a movement such as is represented in the C. S. T. A., many commercial firms have something to contribute; they may therefore be expected to support such a movement if they are going to benefit, directly or indirectly, from it. This argument furnished the foundation for an advertising policy which will be promptly developed and put into operation. The circulation and advertising revenue necessary for the successful carrying on of the commercial programme were, for the reasons stated, felt to be assured. Whether the Executive was justified in reaching such a conclusion, will be best shown by the success attending the publication of the magazine under Society ownership.

President Klinck is expected to return early in September from Europe and will meet some members of the C. S. T. A. Executive at Gardenvale before he leaves for Vancouver. Full consideration will be given to the programme of activities for the coming year and to the question of policy generally.

NITRO-BACTER SOIL VACCINE.

In the June issue of Scientific Agriculture, on page 266, an article appeared under the title "A Bacteriological Analysis and Cultural Test of Nitro-Bacter Soil Vaccine", by Professor D. H. Jones. In this article Professor Jones made the statement that, judging from the sample with which he was supplied, the vaccine was of comparatively little value.

This article came to the notice of Dr. Frank M. Wood, President of the Nitro-Bacter Soil Vaccine Corporation of Chicago who, in commenting upon Professor Jones' article, points out that the analysis made at the O. A. C. and the cultural tests conducted, were not from a fair sample of the vaccine, and should not therefore be accepted as correct. It is claimed that in one particular shipment of the culture, a number of the organisms were either dead or inactive, and it was from this shipment that the O. A. C. sample was taken. In all cases of complaint, new supplies have been furnished, and we understand that a number of new samples, for test purposes, are being given to Professor Jones and other bacteriologists.

The manufacturers of the vaccine have forwarded a number of testimonials received from persons who have used the vaccine commercially and who state that it is giving every satisfaction. It is impossible, however, to come to any conclusion as to the real merits of the vaccine, from a technical standpoint, until further analyses and tests have been made by qualified persons. We have not as yet received the results of further tests now being conducted, either by Professor Jones or by others.

CORRECTING AN ERROR.

In the report of the Committee on Research, published on page 243 of the June issue, a list of those who assisted the Committee was included. The names of Professor M. Champlin of the University of Saskatchewan and of Mr. H. T. Gussow of the Central Experimental Farm at Ottawa were inadvertently omitted. Both these men furnished the Committee with very valuable lists of research problems.

Dusts and Dusting for Insect and Fungus Control

By G. E. SANDERS and A. KELSALL,
Insecticide Investigators, Entomological Branch, Ottawa.

II.—Dusts Containing Copper and Arsenic.

In the last article entitled "The Present Status of Dusting," an endeavor was made to show that the process of dusting was an efficient and economical method for the control of insects and fungi, under the proper conditions. It is proposed to supplement this by a consideration of the materials which are used as dusts, and by a consideration of the factors necessary for successful application. This article will deal with those dusts which contain arsenic in some form as the insecticidal principle, and copper in some form as the fungicidal principle.

Having once arrived at the conclusion that the process of dusting is feasable for practical purposes and that it possesses certain advantages over the process of spraying, it is but natural that suitable compounds of copper should receive careful study. It has been generally conceded that, for certain plant diseases such as the potato blights, copper is a much more active fungicide than sulphur, and under epidemic conditions with most plant diseases the superiority of copper is generally recognized. It is, therefore, apparent that suitable dust substitutes for Bordeaux spray should receive consideration.

As noted in the previous article dusts containing copper are not new. They came into existence coincident with the development of Bordeaux spray, but went very little beyond the experimental stage. However, prepared commercial Bordeaux mixtures in dry form are made in considerable quantity, and although these are primarily designed for mixing with water and for use as sprays, yet they can obviously be utilized for dusting purposes. Recently a copper-arsenic dust described by the writers in the 1918 and 1919 "Proceedings of the Nova Scotia Entomological Society" has come into fairly extensive use. This differs fundamentally from the commercial Bordeaux powders and consequently will be considered separately.

Commercial Bordeaux Dusts.

Paris green embodying both copper and arsenic in one chemical compound is the best known copper-arsenic dust, but it may be dismissed from practical consideration for the following reasons:—

1. When used in such strengths as make an efficient insecticide, the copper content is altogether too low for the requirements of a good fungicide.
2. Its physical properties, density and adhesive powers, are far from perfection.
3. It is too expensive.

The commercial Bordeaux powders are of several types, for the most part made by the mixture of copper sulphate solution and milk of lime, the filtration and drying of the resultant precipitate, and the addition of an arsenical insecticide. The copper content generally varies from ten to twelve per cent, but may be considerably higher and is sometimes less. The powder is diluted as desired with hydrated lime or other "filler." One well known United States firm uses magnesium hydroxide in place of lime, the precipitate being of course of a similar character. These dusts are all of a bright blue colour, are in a very fine state of mechanical division, have very fair adhesive properties, and are capable of forming an excellent dust cloud. These characteristics would lead to the supposition that such dusts are excellent fungicides, and experiments have shown that this view is correct. Experimental data is shown later.

The New Copper — Arsenic Dust.

This dust was first devised in 1917, but was merely used during that year on individual plants in the greenhouse at Macdonald College in order to test its

safety on foliage. During 1918 the total amount used did not exceed half a ton. This was used for the most part by the writers, but C. E. Petch and several other officers of the Entomological Branch used a certain amount as also did Prof. W. H. Brittain, of the Nova Scotia College of Agriculture. In 1919 eight commercial apple growers in the Annapolis Valley gave the material a thorough test, the amount used by them aggregating between ten and twelve tons, and in addition much material was used in experimental work both in Nova Scotia and elsewhere. Until this time the material could be considered as being in a purely experimental stage, but in consequence of the satisfactory results obtained and the obvious economics of this method of disease control, there was created a very considerable demand for the dust in 1920, the consumption of material in Nova Scotia being about three hundred tons. At the time of writing it would appear that this year (1921) about seven hundred tons will be used, and in addition very considerable quantities are being applied at many various points throughout America.

The writers have, this season, definite records of the importation into the Annapolis Valley of Nova Scotia of sufficient material to treat four times 13,000 acres of mature apple orchard with some form of fungicide-insecticide combination. However, much orchard treated is young. Also some persons use less material than recommended, and also a considerable amount of material enters the valley of which no record is obtained. Consequently it is estimated that aproximately 20,000 acres of apple orchard are being at present dusted or sprayed. In round numbers this area is divided as follows:—

8,500 acres treated with spray (mostly Bordeaux mixture).

1,500 acres treated with sulphur-lead arsenate dust.

10,000 acres treated with copper-arsenic dust.

Much of the sulphur-lead arsenate dust is used in conjunction with the copper-arsenic dust as described later. It is apparent from the above figures that the dust is commercially established.

Composition of the Dust.

The fungicidal principle of the dust is dehydrated copper sulphate. During the early experiments the material mostly used was the anhydrous salt $Cu\ SO_4$, but later the copper sulphate mono-hydrate $Cu\ SO_4.H_2O$ has been generally utilized. The first material is white in color, and the latter a very light shade of blue. It is smooth to the touch and of such a fineness that it will pass through a two hundred mesh to the inch screen. The insecticidal ingredient generally used is calcium arsenate, although there have been used many other arsenicals with perfect satisfaction. Taking all the factors concerned into consideration, however, such as the ability to form a good dust cloud, power of adherence, safety to foliage and cost, calcium arsenate is the most satisfactory as far as present knowledge goes. The main bulk of the material is hydrated lime of the ordinary brand.

Copper-arsenic dusts differing considerably from the above, both as to composition and source of material are being used extensively by the officers of the Entomological laboratory at Annapolis Royal, and it is not improbable that as a result of work at present under way, the materials and method of making may be materially altered.

The ingredients have been used experimentally in various proportions, for particularly during the early experiments it was a matter of considerable speculation as to the relative amounts of each that would be desirable. In compounding the dust it was the original idea to make it of such a constitution that the same amount of copper and arsenic would be applied to the foliage of the plant under treatment, as would under normal circumstances be applied by treatment with a standard Bordeaux mixture (2-10-40 for the apple and 4-4-40 for the potato). Obviously to get such a result several factors had to be taken into consideration, the most prominent being the rate of application, and the relative amounts which adhere to the foliage and the amounts which were wasted and went on the ground. Several trials and considerable experience were necessary before these factors could be determined within reason-

able limits. Consequently the original formulae used were later modified. Of course it is also desirable to use differing formulae for different plant diseases and different insects, and for use on different plants, in the same way as various modifications of ordinary Bordeaux mixture are now recommended.

The composition of the dust has always been expressed by the writers in terms of the per cent of metallic copper and the per cent of metallic arsenic. The dusts used on the apple in the large field experiments in 1919 contained three per cent of metallic copper and one per cent of metallic arsenic, while those used on the large fields of potatoes, contained five per cent of metallic copper and two per cent of metallic arsenic. These dusts were expressed as 3-1 dust, and 5-2 dust, respectively, and this system of nomenclature is well understood and in frequent use by farmers and fruit growers in the Annapolis Valley. Since 1919 a 3½-1¼ dust has been used on apples and 5½-2½ used on potatoes.

For purposes of calculation it may be stated that the dehydrated copper sulphate generally contains 35 per cent of metallic copper, and that calcium arsenate generally contains 26 per cent of metallic arsenic. Thus 3½-1¼ dust is composed of ten pounds of dehydrated copper sulphate, five pounds of Calcium arsenate, and eighty-five pounds of hydrated lime.

For mixing, an ordinary dust mixer is used, one similar to those in use by the larger bakeries for mixing flour. This is driven by a small gasoline engine. For the writers' experiments a dust mixer owned by Mr. S. B. Chute, of Berwick, has been used. This has a capacity of a hundred pounds, and with it two men can mix three tons of dust per day, making the cost of mixing about twenty-five cents per hundred pounds. The mixed dust is fairly bulky and a package of about four thousand five hundred cubic inches should be allowed for each one hundred pounds of dust. In Nova Scotia in 1921 on the basis of purchases already made, the mixed dust is being delivered to the grower for $6.00 per hundred pounds.

Properties of the Dust.

After mixing, the dust may be stored in any ordinary dry place. It should, however, be used during the same season in which it is mixed. Otherwise there is some tendency for the material to collect in lumps and prove unsatisfactory.

Containing, with the exception of water, all the ingredients which form an ordinary poisoned Bordeaux, it is only natural that on contact with water on the leaf surface, the dust should form a blue Bordeaux mixture. If the dust is applied to a dry foliage then the first dew or moisture which subsequently occurs on the leaves, changes the dry white dust to a film of poisoned Bordeaux. All using the dust have been particularly struck by the spreading power in comparison with sulphur dust. In the experimental orchard, fifty-five pounds were sufficient to thoroughly dust an acre, while seventy-three pounds of 90-10 sulphur-lead arsenate dust were required for the same area. The sprayed area required one hundred and fifty gallons per acre.

It was realized at the commencement of these dust investigations that the relative powers of adhesion to foliage of the dust and the spray, were important factors in their relative fungicidal and insectidical value. In addition it was realized that from an economic standpoint it was important to know the relative amounts adhering to the foliage, in proportion to the amounts actually projected on to the plant or tree. It was assumed at first that in the application of dust a proportionately larger amount of the material fell to the ground, or was blown away, than in the application of spray. There were no definite grounds for this assumption, and indeed it seems to have been founded on the fact that dust floating through the air attracts more attention than spray falling to the ground. To determine these questions experiments were made with foliage from the large orchard plots.

Adhesion Experiments.

At various intervals through the summer of 1919 five hundred or a thousand leaves were picked from trees from the dusted area, and the same number picked

from trees on the area sprayed with Bordeaux mixture.

These leaves were picked at random in each case from about a dozen or fifteen trees, and from all positions on each individual tree. Each bunch of five hundred leaves was then washed for three or four minutes in one thousand cc. of water containing four cc. of concentrated nitric acid. This solution was then filtered from the leaves, and the copper in the solution was quantitatively determined by the colorimetric method of Winston and Fulton (The Field Testing of Copper-Spray Coatings, Professional Paper. Bul. No. 785, U. S. Dept. of Agric.) The arsenic in the solution was quantitatively determined by the Gutzeit method as modified by Sangar and Black.

The following tables show the result of these determination expressed in miligrams per one thousand leaves, together with the amounts of metallic copper and metallic arsenic applied to the trees, expressed as pounds per acre. The poisoned Bordeaux mixture used was of the 2-10-40 formula with one pound of calcium arsenate, and there were applied one hundred and thirty three gallons per acre for each of the first two applications and one hundred and fifty gallons per acre for each of the last two applications. The dust was of the 3-1 formula, and there were applied fifty pounds per acre for each of the first two applications, and fifty-five pounds per acre for each of the last two applications.

Poisoned Bordeaux Mixture.

Dates of Application	Amt. of Cu. applied in lbs per acre	Amt. of As. applied in lbs per acre.	Dates of determinations	Miligrams of copper per per 1,000 leaves	Milligrams of arsenic per 1,000 leaves
May 13th	1,66	.83			
May 24th	1.66	.83			
			June 1st	30	15
			June 9th	15	8
June 9th	1.88	.94			
			June 10th	40	20
			June 17th	45	22
			June 19th	35	18
June 21st	1.88	.94			
			June 21st	100	50
			June 30th	90	44
			July 10th	45	25
Dust.					
May 14th	1.5	.5			
May 24th	1.5	.5			
			June 1st	25	10
			June 9th	5	3
June 10th	1.65	.55			
			June 10th	45	23
			June 17th	30	12
			June 19th	25	10
June 20th	1.65	.55			
			June 21st	85	30
			June 30th	60	28
			July 10th	10	4

In explanation of the above table it may be stated that the successive increase in the amount of copper and arsenic present upon a thousand leaves immediately after each application, is of course due to the increase in size of the leaves. There is evidently some error in the determinations of June 10th and June 17th in the case of the Bordeaux spray, as the latter shows a higher amount of copper and arsenic present than the former although there was no intermediate application.

Although these determinations are not sufficiently exhaustive to make observations in detail on the comparative adherence of spray and dust, yet they are sufficient to establish certain points. It will be noticed that the actual amounts of copper and arsenic used per acre in each application, were greater in the spray than in the dust. Nevertheless the amount detected immediately after application were but little greater on the sprayed foliage than on the dusted. It is obvious that the wastage of material in the process of application is no greater in dusting than in spraying. In fact according to the figures given, spraying is a trifle the more wasteful.

A perusal of the determination reveals the fact that the sprayed material has a greater power of adherence than the dusted. In all cases the amounts of copper and arsenic on the dusted foliage decreased more rapidly with the lapse of time than the copper and arsenic on the sprayed foliage. This must be regarded as a defect in the dust, a defect which will have to be remedied by a close observation of the foliage, and by the application of an additional dust following heavy rains if circumstances seem to warrant it. Under Nova Scotia conditions in the orchard, it is not usual to expect a fungicide-insecticide to function more than twelve days on account of the need of fresh applications to cover new growth. For this period of time the dust will usually be effective.

Physiological Effect on Fruit and Foliage.

On the foliage of the apple no purely physiological effects, either beneficial or detrimental, have been observed from the use of dust of the formula given in this article. To determine the limits of safety of the dust, a series of experiments were conducted during the past three seasons. Small orchard plots were treated with dusts of the following formulae:—

1. 0% Cu — 1% As.
2. 1% Cu — 1% As.
3. 2% Cu — 1% As.
4. 3% Cu — 1% As.
5. 4% Cu — 1% As.
6. 5% Cu — 1% As.
7. 6% Cu — 1% As.
8. 7% Cu — 1% As.
9. 8% Cu — 1% As.
10. 10% Cu — 1% As.
11. 2½% Cu — 0% As.
12. 2½% Cu — 1% As.
13. 2½% Cu — 2% As.
14. 2½% Cu — 3% As.
15. 2½% Cu — 4% As.

On all these plots no foliage injury that would be noticed by a casual observer was apparent. However, the foliage of plots 9 and 10, and to a very small extent that of plot 8, was more or less mottled with the minute purple spots typical of incipient copper injury. No arsenic injury was apparent on any plot. It is evident from the foregoing that dusts of the formulae proposed are absolutely harmless to foliage.

Material.	Applications made	P.C. of apples russetted.
3-1 dust	Semi-dormant only	0.
3-1 dust	Pink application only	7.6
3-1 dust	Calyx application only	12.7
3-1 dust	Ten day application only	0.
3-1 dust	All four applications	14.2
2-10-20 Bord-calcium arsenate spray	Semi-dormant only	0.
do. do.	Pink application only	10.9
do. do.	Calyx application only	20.8
do. do.	Ten day application only	0.6
do. do.	All four applications	28.2
3-1 dust and 90-10 sulphur-lead arsenate dust	All four applications, the 90-10 being used for calyx application only	5.8
2-10-40 Bord-calcium arsenate spray, and 1.40 soluble sulphur-calcium arsenate-lime spray	All four applications the soluble sulphur spray being used for calyx application only	10.3

On the fruit the dust causes a certain amount of russetting similar in nature to that produced by a Bordeaux spray. This russetting, however, is not as serious as that produced by the spray, due in part, in all probability, to the larger excess of lime present. Also this russetting is almost all caused by the application of dust at the period immediately following the falling of the blossoms, as is the case with Bordeaux spray. The russetting is in no case serious and is reduced to a negligible quantity by the substitution of the sulphur for this one application. The foregoing table shows the percentage of russetting produced on Wagener apples by applications of various dusts and sprays at different periods.

The last spray combination on the table, giving 10.3% of russetted apples, is from the 1919 Nova Scotia Spray Calendar and is in general and very satisfactory use. So it is obvious that four applications of dust would be expected to give slightly more russetting than the spray calendar, and that the substitution of sulphur dust for the calyx application would give about half the russetting of that produced by following the Spray Calendar.

Control of Insects and Fungi by Means of Dusts containing Copper and Arsenic.

The cumulative evidence to be gathered from the observation of hundreds of orchards treated with various materials, is more impressive to the observer than several experimental orchards. A survey of the Annapolis Valley led to the conclusion that for 1920 the copper-arsenic dust of $3\frac{1}{2}$ - $1\frac{1}{4}$ formula was the equal of Bordeaux spray in fungus control but slightly inferior in insect control. In that particular year both seemed somewhat superior to 90-10 sulphur-lead arsenate dust. Areas treated with any of the three materials were much superior to areas which had received no treatment.

During the past several years in the course of these investigations, the writers have used several hundred small plots of two trees or so to a plot. On all these areas where the per cent of arsenic in the dust was 1% or more the control of biting insects was good. It is to be regretted that no opportunity has been found for testing the material in the control of an epidemic outbreak of codling moth. This insect, never very prevalent in Nova Scotia, has lately been particularly conspicuous by its absence.

The chief experimental area for these materials used by the writers has consisted, for the past few years, of a fifteen acre block of orchard of the Gravenstein variety, situated in Berwick and owned by Mr. S. B. Chute. Unfortunately, for experimental purposes, insect pests have not been numerous in this orchard but

Table 1. *Results from S. B. Chute's Orchard.* 1919.

Material	No. of apples counted	Clean	Scab	Russetted	Bud-moth	Codling moth	Green fruit worm	Tussock moth
		p.c.	p.c.	p.c.	p.c.	p.c.	p.c.	p.c.
Unsprayed ..	5,500	0.19	98.81	0.16	2.98	0.11	3.12	0.78
Sprayed as per 1919 Nova Scotia Spray Calendar	5,500	77.89	21.14	2.16	1.58	0.16	0.89	0.07
Dusted with 3-1 copper Arsenic dust	5,500	73.49	20.45	0.23	3.32	0.07	2.14	0.27
Dusted with 90-10 sulphur-lead arsenate dust	5,500	85.29	11.4	0.	2.32	0.	1.9	0.03
Dusted with commercial Bordeaux ..	5,500	67.82	27.9	2.09	1.96	0.01	2.51	0.

black spot has always been prevalent. The commercial Bordeaux dust used in these experiments was diluted to contain the same copper and arsenic equivalent as the copper-arsenic dust.

The insect injuries, as will be seen, were insignificant on all plots, but the differences in scab were remarkable. The figures in the foregoing table give a very inadequate idea of the scab control on the treated areas. On the unsprayed area practically all the apples were scabby. Moreover each apple contained a great number of scab spots and many were cracked, and the apples were dwarfed in size. On the treated areas the apples which were scabbed usually contained only one or two scab spots and those generally small.

The 90-10 sulphur dust gave the best control, but this plot was slightly favored, being on somewhat higher ground and consisting of a trifle smaller and more open trees. The 3-1 copper-arsenic dust gave very good control indeed, considering the severity of the infection. And in this connection it is worth while pointing out that the quantity of the copper applied was less than that applied in the Bordeaux spray. This was due to the under estimation of the spreading power of the dust, in making up the formula. It is interesting to note also that in this orchard the russetting of fruit was negligible.

Table 2 shows the results obtained in 1920. Here the copper and arsenic content was made higher.

That the fungicidal value of the copper-arsenic dust can be still further increased by raising the copper content of the dust is shown from the results of Table 3. The treated areas in this experiment were all dusted with sulphur lead arsenate dust on the third application, the other three applications consisting of the copper-arsenic dust.

In the S. B. Chute orchard the apples from the various plots were picked separately and turned in to the packing warehouse. Table 4 shows the pack out as obtained from the foreman, expressed in percentages.

Table 2. *Results from S. B. Chute's Orchard*, 1920.

Material	No. of apples counted	Scab p.c.	Russetted p.c.	Bud-moth p.c.	Cod. ling moth p.c.	Green fruit worm p.c.	Tussock moth p.c.
Unsprayed	4,000	72.4	0.3	2.8	0.1	3.8	0.4
Sprayed as per Nova Scotia Spray Calendar	4,000	29.7	3.9	3.4	0.02	1.9	0.8
Dusted with 3½-1¼ copper arsenic dust	4,000	24.2	8.0	5.8	0.06	1.8	0.1
Dusted with 90-10 sulphur-lead arsenic dust	5,000	40.0	2.8	5.7	0.04	1.8	0.1

Table 4.

	No. 1 p.c.	No. 2 p.c.	No. 3 p.c.	Domestic p.c.	Culls p.c.
Unsprayed	19.2	9.5	32.2	36.2	2.7
Nova Scotia Spray Calendar ..	48.5	16.6	18.0	14.7	1.8
Dusted with 3½-1¼ copper-arsenic dust	57.5	12.3	12.3	16.5	1.3
Dusted with sulphur-lead arsenate dust	34.0	17.5	16.2	29.5	2.7

Table 3.

Dusts of Different Copper Content.

	No. of apples counted	Scab p.c.	Russetted p.c.
Unsprayed	4,000	72.4	0.3
Dusted with 4-1¼ copper-arsenic dust . .	4,000	19.5	4.0
Dusted with 4½-1¼ copper-arsenic dust . . .	4,000	15.5	3.5
Dusted with 5-1¼ copper . .	4,000	15.6	14.1

Conclusions.

From the above data it is evident that dusts containing copper and arsenic are effective in controlling biting insects and black spot under the conditions existing in Nova Scotia. Some commercial Bordeaux powders are possibly as effective as the copper-arsenic dust here described, but it is almost certain that commercial Bordeaux mixtures can never be as cheaply made. The writers have probably done more work on potatoes with these dusts than on the apple, but it is considered advisable to reserve this phase of the question for a future paper. In the last paper the question of relative costs was briefly discussed. It was shown that sulphur-lead arsenate dust was a trifle more expensive than spray, that spray was somewhat more expensive than the copper-arsenic dust, and at the same time it was shown that apart from the matter of relative costs, dusting possessed certain definite advantages over spraying in the control of biting insects and fungous diseases. It would seem apparent therefore that the copper-arsenic dust described or some other dust containing copper and arsenic which may in the future come to light, should play an important part in plant pest suppression.

The Technique of Field Husbandry Experimentation

By MANLEY CHAMPLIN
Professor of Field Husbandry, University of Saskatchewan.

(An address before the Western Canadian Society of Agronomy at Edmonton.)

Objects in View.

In planning a set of experiments our first care must always be to determine what the problems may be that confront the people whom we serve. A certain class of problems may be worked out very satisfactorily on an experimental station. Another class cannot be worked out to a satisfactory conclusion on the experiment station and must be solved, if solved at all, by cooperative work with farmers.

The primary objects of field husbandry experimentation consist first in finding out the best way to produce farm crops, and second to introduce or breed new varieties that will be better adapted to local conditions than those already existing. Such experiments as are designed to learn the best dates of seeding, the most profitable rotation of crops, the best tillage methods and the most satisfactory methods of replenishing the soil can be worked out to best advantage by the use of a series of carefully planned plot experiments. Plant breeding or crop improvement work requires the use of a smaller unit such as a short row. Such experiments may be known as nursery work. After the best of the new or baby strains grow up they are transferred to the field plots. Experiments such as the reseeding of worn out range lands, seeding wet land to grass mixtures, the determination of the value of new varieties in different localities and many another are best adapted to cooperative experimental work with farmers. Without *any one* of these three classes of experimentation we will fall short of our full accomplishment and will not see fully realized our great desire to do some good "in the land which the Lord our God

giveth us" or in other words to be of real service in making our district or province a better place in which to live.

In presenting this paper, I feel no small degree of diffidence, having been among you for but a few months, but I have been acquainted with the work of your experimental farms for many years and remember well that some of the best things we had in improved varieties of wheat and barley in my former home in South Dakota traced back to the Canadian experimental farms. I have also had the good fortune to be able to visit a great many of the stations in the Great Plains region from Texas to Manitoba and Saskachewan and have followed the work at these stations with much interest. It occurred to me when your chairman asked me to speak on this subject, that a brief description of methods used might not come amiss.

Plot Experiments

In carrying out all phases of experimental work, it is essential that a policy of systemetizing and standardizing be initiated and followed throughout. A further essential is that everyone engaged in the work be encouraged to be neat and careful in all things. I do not mean to say that good work has never been done in a slovenly work shop but I do want to emphasize the fact that much better work is possible if good working conditions are maintained. You know there is an old saying that it goes hard with the land where wealth accumulates and men decay. It is equally true that it goes hard with the scientific work on an experiment station where junk accumulates and men decay. It may not be best to adopt too rigid a system and thus discourage initiative on the part of the individual. A certain amount of initiative is most desirable. The best example which I can recall of an extensive line of experiments carried on by a rigid and thorough system is that conducted by the Office of Dry Land Agriculture of the United States Department of Agriculture under Chilcott and Cole. A good example of a policy wherein the general ground work of the experiments is planned at head quarters, but wherein the utmost is left to individual initiative, is the work of the Office of Cereal Investigations under Carleton, Ball and Warburton in the same department. Both of these policies and methods have their values under certain conditions.

Professor M. Champlin.

Plot experiments, in general, must be very carefully standardized and permitted to run through a long period of years. Nursery work and cooperative experiments may be much more erratic. The nursery is largely for the benefit of the breeder himself and the cooperative experiment is largely for the benfit of the farmer and his immediate neighbors. It may never be tabulated and published, while plot experiments should be so well planned that one can tabulate and publish the results and draw definite conclusions therefrom.

Size of Plots

A number of inquiries have been conducted for the purpose of determining what size and shape of plot to use. The outcome of such inquiries is that the plot should be as large as practicable

and that a long narrow plot is preferable to a square one or a wide oblong because there is less tendency for variation in the soil sufficient to influence results in a long narrow piece of land than in a square or nearly square one. I have found that plots which are two rods wide and eight rods long, containing one tenth of an acre are very convenient. This style of plot is used in nearly all the Dry Land Agriculture experiments from Texas to North Dakota inclusive. These plots are usually separated by alleys or division strips 40 inches in width which are kept cultivated. An alley of this width permits cutting of the grain with a five foot binder and leaves very little danger that the crops on adjoining plots will become mixed if the crop is lodged. I have tried using acre blocks for certain classes of tillage or planting experiments such as listing versus drilling versus check planting corn and found them satisfactory for this type of work but for ordinary plot experiments the acre size is too cumbersome. In laying out an experimental field of this kind, the field is first staked off in strips 132 feet wide with 20 foot roads between them. These strips are designated as series. Next, these series are divided into blocks 360 feet in length. Iron stakes made out of $1\frac{1}{4}$ inch pipe are set as markers in the middle of each 20 foot road to locate the end of the blocks. These stakes are preferably 18 inches long and set with 17 inches in the ground. It is well worth while to set them in concrete to make the mark permanent and easy to find.

Replication of Plots.

All experimental plot work should be repeated as many times as possible each season. Duplicates are better than singles and triplicates are better than duplicates, because the results when averaged tend to equalize. Mathematical attempts to correct errors arbitrarily by means of check plots, planted at intervals as was formerly the custom on many stations, are likely to lead one into greater errors than if the actual yields are used, because the several mathematical methods of correcting yields to conform with check plots are all based upon the false hypothesis that the land between check plots varies uniformly.

It is better to limit the work to that which can be well done and sufficiently replicated rather than to be too ambitious and attempt to do so great a mass of work on a small piece of land that no definite conclusions can be drawn even after the work is done.

Only One Thing at a Time

It is hardly necessary to emphasize the desirability of having but one variable and keeping all other conditions of an experiment as uniform as possibe. I recall one station superintendent who planned to kill two birds with one stone as he said. He planted different varieties on his rotation plots, thus hoping to get a comparison of varieties and rotations at the same time. It would have been a fine scheme if it had worked but for some reason the superintendent resigned and his successor reverted to the old plan of doing but one thing at a time.

Experimental Farm Practice

For the most part, ordinary machinery can be used with satisfaction but there are certain special requirements for some of the experimental machines that may well be enumerated.

Plowing.—In order to avoid forming dead furrows or back furrows on small fields a two way plow is desirable. These can be had in either mold board or disc type. The disc plow is very useful for plowing in dry weather. I have frequently found it necessary to do all fall plowing with a disc plow.

Planting.—For loam soils, in good condition, I like a double disc drill. For light or sandy soils, a single disc drill with press wheel attachments is very suitable. For clay soils, the single disc without press wheel attachments, gives good penetration. Seven feet in width with 14 furrow openers is a convenient size. Two horses can pull a drill of that size easily so that there is no trouble driving straight. Row crops such as corn, require a two horse corn planter for convenient handling.

Cultivating.—For fallow ground the duckfoot cultivator is almost indispensable and from reports which I have heard of the rotary rod weeder I feel sure it will be useful, especially on light soils that can-

not be pulverized too much for fear of causing drifting. If one has any considerable amount of row crops to care for, it will pay to get a two horse cultivator. It can be manipulated to much better advantage than a one horse implement, although the latter is needed for cultivating alleys between plots.

Harvesting.—A five foot binder is the most convenient size for plot harvesting. It can be pulled by one team of horses and the space between bull wheel and sickle is such that no injury will come to the next plot when cutting out the first round.

Threshing.—In selecting a threshing machine some of the main points to keep in mind are first to get one that is easily cleaned and easily accessible. There should be a slide under the cylinder to be removed whenever the variety is changed. A canvass to catch straws and other material at the head of the machine is needed. For ordinary plot work the 20 inch machine is most satisfactory. For nursery rows, a special nursery thresher, consisting of a cylinder and fan but no sieves, should be provided.

Weighing.—If no wagon scale is available for weighing grain and straw before threshing, the same purpose is easily accomplished by providing a weighing box for an ordinary platform scale. This scale may well be anchored to a stone boat and moved when necessary. If care is taken to adjust the threshing machine to do clean work, the grain may be weighed and the test weight per bushel determined at the machine. This method conserves time and it is well worth while to make an effort to put the grain through reasonably clean.

Care of the Seed Grain.—After the seed is taken to the seed house it should be cleaned, recleaned and sampled. The samples should be tested immediately for germination and any lots which do not show good germinating power should be discarded, except that some may be retained for continued experiments. A two year's supply of seed for the station should first be set aside and then the remainder of the seeds may be invoiced and listed for distribution. All seeds of a given crop should be grouped and then arranged within the group either alphabetically or by accession numbers, so that any lot of seed may be located without loss of time.

Care of the Label Stakes

All label stakes should be brought in, in the fall and carefully piled or laid away in an orderly manner. Then during winter they may be easily checked over and any missing ones may be replaced. A considerable saving of labor can be had by standardizing the stakes for different purposes. For example, stakes for one tenth acre and larger plots may be five inches in width, those for smaller plots three or four inches and those for nursery rows two inches. In nursery row work, it is sufficient to stake every fifth row. Thus the stakes for nursery work will be numbered 5, 10, 15, 20, etc.

Records of Experimental Work

The main product of an experimental farm is information. This information of course must be based on records. For that reason the records are the vital crop of the experimental farm, just as truly as the crops themselves are vital to a commercial farm. I have known of so many thousands of dollars worth of experimental work going to waste because of unsystematic or inadequate records, that this need has been deeply impressed on my mind. I have known field superintendents who put the work of the season through with the greatest care and accuracy only to fall down in the matter of records. Then too, the offices should be so arranged that the results may be quickly and easily summarized at the close of each season, so that they will be available to teachers and extension lecturers. In other words, the experiment station's office should be run with the same efficiency and "up-to-dateness" as the office of a live bank. On account of the experiment stations being public institutions, this is not always possible, and all too often an experiment station office becomes the repository of infinitely valuable information, but known to no man, because it has never been properly digested, due to lack of a sufficient office force.

However, much can be done by arranging the records in systematic form and in such shape that they may be kept up to

date with no duplication of effort. I have found printed field books a great convenience. These have headings inserted and are ruled into ten columns per page so that each page takes care of ten plots or rows and a book of 100 pages is sufficient to record 1,000 plots. Such books may contain all seasonal data such as time of planting, emerging, heading and ripening, stand, disease, yields, etc.

To supplement the field books, map records are desirable to show the history of the land at a glance. These records may be drawn conveniently into a book ruled quadrilaterally in centimeter squares. One map may show the crops planted, another one the kind of soil preparation and a third one the yields obtained for each season. This series of maps makes a convenient and permanent history of the land which can be quite conveniently used for reference. In addition to the field books and map records, summary record sheets or books are desirable so that all yield records may be tabulated and averaged each season at the close of the season's work.

Thus the men in charge will know the results and will be able to bring them together quickly for the information of their constituency.

Conclusion

I have pointed out the value of system and standardization in laying out the fields and in making the records and I have tried to emphasize the advantages to be attained by holding the work well within bounds and attempting to do no more work than can be done thoroughly. I have offered a few practical suggestions for carrying on the work. It is hoped that some of these suggestions may be of value to my co-workers. At any rate, they may furnish material for further profitable discussion.

Distribution of Elite Stock Seed

By MANLEY CHAMPLIN, Professor of Field Husbandry, University of Saskatchewan.

(Paper prepared for Canadian Seed Growers' Convention, Ottawa, June 6th, 1921).

During the past ten years Professors Bracken and Cutler and their associates have been carrying on selective breeding of wheat, oats and barley and for the last five or six years Professor Kirk has been carrying on selective breeding work with alfalfa and more recently with sweet clover.

As a result of this work, pure line strains of some of the cereals had been developed when the writer assumed his duties last September. In addition to the pure line strains coming up from the plant breeding nursery, certain stocks of wheat, barley, alfalfa and sweet clover had been very carefully purified and reduced to the uniform type by roguing and seed selection. In the fall of 1920 sufficient amounts of seed were available to warrant us in starting a system of seed distribution.

In Saskatchewan, nearly all the agricultural districts have local organizations known as Agricultural Societies. The executives of these societies have an annual meeting at the University in January. All of our seeds were invoiced and catalogued and announcements were made at the Agricultural Societies' Convention last January. Seed lists or catalogues were mailed to each society soon after the meeting. Sales were not restricted to members of the Agricultural Societies and seed lists were furnished to anyone upon request. But the Agricultural Societies had first chance at these seeds. In some instances the societies arranged for several plantings and sent in orders for considerable stocks of seeds. Individual orders rapidly took up the remaining stocks with but three or four excep-

tions. Rubber stamps with the words "Stock Exhausted" were used to take a variety off the list as soon as all was sold. The seed list gives in detail the names of the varieties sent out, the maximum amount per person and the prices charged. Our aim was to furnish enough seed of wheat, barley and oats to seed ten acres or a little more and sweet clover or alfalfa or brome grass seed enough to sow five acres in rows three feet apart.

Approximately 250 orders were received representing about 400 lots of seed sent out. Each of those who obtained alfalfa or sweet clover seed was furnished a pint of inoculated soil and a small piece of furniture glue with full instructions for inoculating the seed.

The Saskatchewan Field Husbandry Association was organized for the purpose of bringing all of those who are growing University seeds or carrying on co-operative experiments, under one organization.

Each grower of University seeds and each one carrying on a test under our direction automatically becomes a member. Members of the Canadian Seed Growers' Association who are growing registered seed in Saskatchewan, officials and others interested in crop improvement may have their names enrolled upon request.

The work of the Association is divided into three definite parts:—

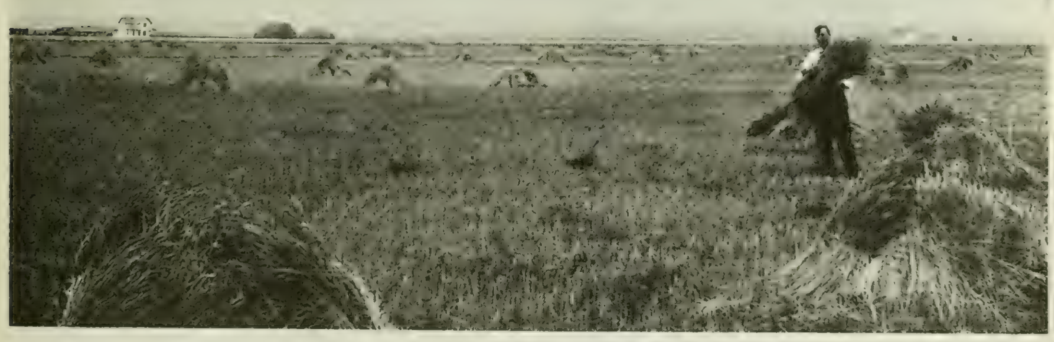
1. Growing and distribution of University seeds, preparation of educational circulars and direction of co-operative experiments with farmers by the University Field Husbandry Department.

2. Growing increased crops from University seeds and carrying on co-operative tests of field crops by the active members of the association.

3. Inspecting fields and bins for the purpose of seed registration under the C. S. G. A. rules, issuing a Saskatchewan Seed Catalogue, furnishing names and data to the C. S. G. A. and otherwise assisting in the marketing and commercial phases of the project by the Field Crops Branch, Department of Agriculture, Regina.

It is believed that this division of work will make it possible to carry out each phase in an efficient manner. Of course, the field and bin inspection will necessarily be limited to those who are accessible, either by reason of being in a group or seed growers center or being easily reached from the railroad station.

We will do everything possible with our limited staff to follow up these seeds and make every farm on which they are growing, a branch of the University and Department of Agriculture. By co-operating with the Agricultural Societies as local agencies and the Canadian Seed Growers' Association as the federal agency and record office, we hope to make the seed distribution work increasingly effective.



Harvesting Registered Seed Wheat.

Natural Control Investigations in Canada

By JOHN D. TOTHILL,
Entomological Branch, Ottawa.

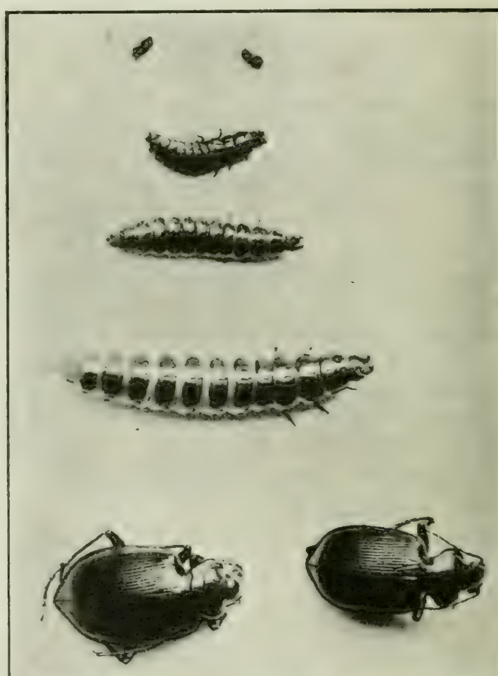
It has been estimated that about ten per cent of our crops are destroyed annually by insect pests, and this represents a huge monetary loss to the Canadian farmer because it has to come out of his profits. The farmer is working on a narrow margin, as his profits can scarcely average more than twenty per cent of the value of his crop. If it costs, for instance, about seven hundred and twenty dollars to produce nine hundred bushels of one dollar wheat, then the farmer's profit is one hundred and eighty dollars, or twenty per cent of the total value of the crop. Without the insect pests he would have grown a thousand bushels instead of nine hundred and at exactly the same cost. Instead of his profit being one hundred and eighty dollars it would be two hundred and eighty. The insects in this illustration destroy slightly more than thirty per cent of the farmer's profit, although they only destroy ten per cent of his crop.

The Entomological Branch exists for the sole purpose of reducing this huge monetary loss by finding out how to control the various pests.

There are two methods of control in common use; the artificial and the natural. The artificial includes the use of poison or contact sprays, of repellants (such as sticky bands), of cultural methods of control and so on; and the natural method consists essentially in preventing and decreasing damage by seeing to it that all the natural enemies of the pest are at work. These two methods supplement one another and neither is complete without the other.

Natural control investigations have been in progress in Canada for a decade, and it is my privilege to explain what has been done and with what results.

The first project was the introduction into Canada of the native enemies of the Brown-tail Moth. This insect was a native of Europe that had become introduced on nursery stock into the New England States, whence it had spread into Nova Scotia and New Brunswick. Its chief insect parasites had been left behind in Europe and consequently it became a first-class pest in its new home. Two insect parasites and a predaceous beetle were colonized in large numbers at vantage points in Nova Scotia, New Brunswick and Quebec. Within a few years of liberation these natural enemies of the Brown-tail Moth became established and distributed over the infested areas. The result of this project has been highly gra-

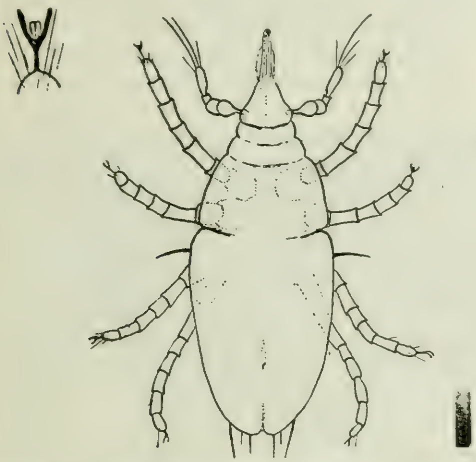


Calosoma sypochanta.—This useful beetle now destroys many injurious insects in Eastern Canada, where it was introduced to lessen the danger from the Brown Tail and Gipsy Moths.

tifying, as there has been a notable decrease of the Brown-tail Moth in both Nova Scotia and New Brunswick during the past two years. There is no longer any need for viewing the Brown-tail Moth situation in the Maritime Provinces with alarm, and as a result of the reduction of the numerical strength of the insect the cost of artificially controlling the spread of the insect by

the maintenance of an orchard survey has been reduced in New Brunswick by about seventy-five per cent.

With the Brown-tail Moth problem there was also a Gipsy Moth problem. This insect had also become established in the New England States and its parasites had been left in its native Europe. The parasites



Hemisarcoptes.—This microscopical creature makes a living by feeding upon eggs of the Oyster Shell Scale.

were the same trio that attack the Brown-tail Moth and as these are now established at all strategic points in Canada we can wait for the coming of the Gipsy Moth into Canada, confident that it will not occasion with us the million dollar losses that it occasioned in the New England States before the introduction of its natural enemies.

The next project had to do with the Oyster Shell Scale. Like the above-mentioned insects, this pest of orchard trees came to us from Europe and for the first fifty years it did untold mischief, destroying a very large number of apple orchards north of the Mason-Dixon line. Its chief enemy, a mite that is microscopical in size, then seems to have arrived from Europe on nursery stock and the pest no longer threatened the entire orchard industry. In places the Scale disappeared entirely and its appearance and disappearance has gone on in irregular cycles down to our day.

In studying the insect in Canada, a peculiar condition was found in British Columbia. The scale insect arrived there on nursery stock in about 1885 and it is now scattered over Southern British Columbia, including the fruit-growing areas of Vancouver Island, the Lower Fraser Valley and the Okanagan valley. It was found to be increasing rapidly in the last-mentioned place and not a single one of the useful mites was found in material collected from representative places throughout British Columbia. The Scale had found its way into British Columbia but its foremost natural enemy had been unable to follow. Some of the mites were immediately introduced from New Brunswick and the results awaited with considerable interest. Two years later the mites had become so numerous that they had destroyed all the Oyster Shell Scales within distance of the most important colony, which was liberated at Vernon in the Okanagan Valley.

Another insect that has given a good deal of trouble is the Oak Looper that periodically defoliates the oak trees which have so much to do with real estate values in the neighbourhod of Victoria. A predaceous beetle has been introduced, but it is too early as yet to know with what results.

Apanteles lacteicolor.—Cocoons of this important enemy of the Brown Tail and Gipsy Moths being picked from a rearing tray for liberation in Eastern Canada.

In studying the Forest Tent insect a curious situation was found in Alberta. In the Sylvan Lake district there was an outbreak of the insect, destroying a good deal of the Trembling Poplar, used locally for building log barns and houses, and for the ordinary needs of homesteading. None of the insect parasites that attack this pest were present, as the moths had evidently

been blown across the Prairies for hundreds of miles and had left their enemies behind. The most important parasite — a two winged fly — was collected near Vancouver and colonized at Sylvan Lake and it is expected that this will assist in reestablishing the natural balance of things. It is too early as yet to know how much good will accrue from this project but there will of necessity be some improvement in the situation.

The Fall Webworm, Forest Tent Caterpillar and Spruce Budworm have been studied intensively for several years and throughout the Dominion and these studies have served as a background for developing the various practical projects. They will serve also as foundational studies upon which to base future practical projects that may be undertaken. They have served to emphasize the wastefulness of an agriculture that is carried on without the aid of natural enemies of insect pests. They have shown that there are probabilities of saving millions of dollars by using intelligently all the natural means at our disposal for the control of agricultural pests.

There are two objectives for natural control work in Canada. One is to regulate within the Dominion the distribution of the natural enemies of injurious insects. The other — and more important — is systematically to introduce all the parasites of our imported pests that are not already here. Our agricultural pests are, for the most part, imported from foreign lands and many of the parasites have been left behind. These two objectives cannot be attained at once or even in a decade. They are of practical attainment, however, and within our own generation. With the objectives reached, there should be millions of dollars saved annually to our agriculture and the investment will yield interest for all generations to come.

The Apple Sucker (*Psyllia mali* Schmidberger) in Nova Scotia

By W. H. BRITTAIN,
Provincial Entomologist.

Present Distribution.

This injurious insect was first found in Nova Scotia in 1919, though doubtless introduced some years before on nursery stock from Europe. It is now spread over a considerable territory including parts of the counties of Kings, Hants, Halifax, Colchester and Cumberland. It is most abundant at present in the Wolfville and Cornwallis districts.

The insect is a well known and much dreaded enemy of the apple in Northern and Central Europe, including Norway, Sweden, Russia, Caucasus, Germany, Austria, Czecho-Slovakia, France and in Japan. In some of these countries, at least, it is said to be the most destructive, or one of the most destructive, apple pests. For this reason a short popular account of the insect and its work may be of interest to readers of this journal.

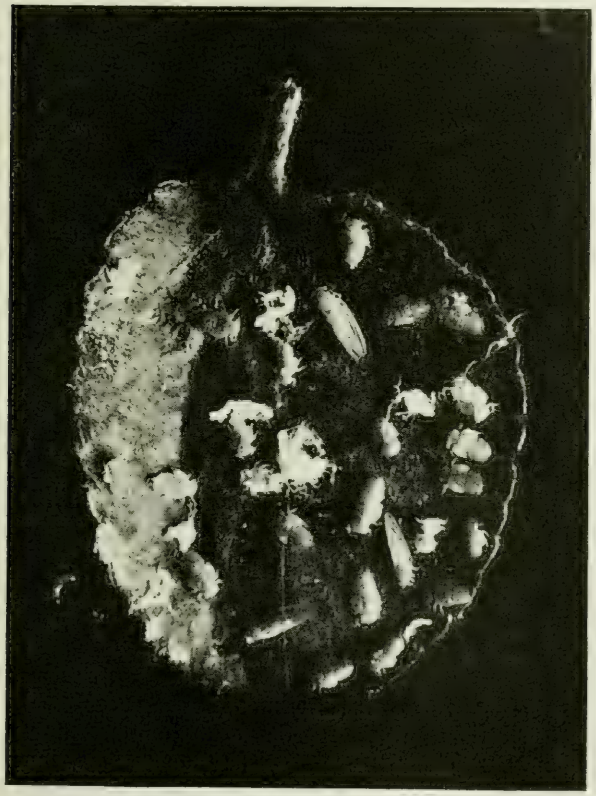
Kinds of Plants Attacked.

The apple is the only important food plant, and by some writers it is said to be the only food plant, that is attacked. The rowan or mountain ash (*Sorbus aucuparia*) is also said to be attaked in Europe, while in Nova Scotia it has been found to a slight extent on quince and pear. The common insect attacking the pear is, however, not this species, but a related one, viz., the pear psylla (*Psyllia pyricola* Foerst.)

The Insect.

The first indication that the grower is likely to have of the presence of the pest will be the dripping from the trees of small drops of a whitish, sticky liquid, which, in severe cases, rains down from the trees at the slightest disturbance. On examination, the leaf and flower stalks will be found to be infested with small yellowish or green insects, somewhat resembling aphids, but flatter and more disc-like in form. They are the young or nymphs of the apple sucker (*Psyllia mali* Schmidberger) and the sticky liquid is their fluid

excrement covered by a layer of whitish wax secreted by pores around the anal opening. In the mature state the insects possess two pairs of transparent wings. They also acquire the power of leaping considerable distances. It is this habit that has given the family, to which this insect belongs, the popular name of "jumping plant lice" to distinguish it from the ordinary plant lice or aphids which insects they somewhat resemble, but which do not possess this ability. When they first emerge the adults of both sexes are greenish or yellowish green, but as the season advances, they take on a more brilliant coloring, much more pronounced in the case of the female.



Nymphs and adults on leaf.

Blossom Injury.

Habits and Seasonal History.

The insects emerge when the buds of most varieties are about half open, and immediately they hatch, they make their way into the buds. This is the reason that we cannot control them by spraying just after hatching as we can aphids, which, upon emergence from the egg, cluster at the tips of the buds and are therefore readily destroyed.

The insects feed, at first, at the base of the leaf or flower stalk, the flattened form of their body enabling them to wedge themselves well down into the axil of the stalk. They remain thus for some time sucking the juice from the plant and excreting copious quantities of the sticky secretion or "honey dew" already referred to. As they approach maturity they move out and feed all along the flower and leaf stalks and even upon the blade of the leaf itself.

The total interval between hatching and the adult state is from four to five weeks. The adults remain upon the trees feeding slightly, but doing no apparent damage, until late in the fall, even after several severe frosts. Egg laying, however, does not commence until September, the females

depositing their tiny yellowish eggs upon the wood of the current season's growth, chiefly upon the fruit spurs.

Injuries Caused by the Insect.

The chief results of the insect's work are the shrivelling up of the blossoms and the turning yellow and subsequent dropping of a large proportion of the leaves. There appears to be no definite "poisoning" of the affected parts, such as characterizes the work of the green apple bug. The damage seems to result entirely from the loss of sap, which, in severe cases, is considerable. Where there is a good set of fruit, the insects may be quite numerous without the damage being very great, but where there is a moderate or light set the damage is proportionately much greater. It is also altogether likely that the injury will prove to be cumulative and increase in intensity from year to year.

How to Control.

1. The method that, up to the present, has proved most satisfactory, is to spray with nicotine sulphate (Blackleaf 40) in the strength of ¾ of a pint to 100 gals of water, using a pressure of at least 250 pounds and taking care to thoroughly drench the entire tree. This is applied at the "blossom pink" stage, i.e. just before the blossoms open.

2. Dust mixtures containing finely powdered tobacco dust or nicotine-sulphur dusts containing two percent or more of Blackleaf 40, also destroy a large proportion of the insects, when applied at the same period, but are not as effective as a spray properly applied. If dusting is practiced, about twice as much material should be used as in ordinary dusting and the greatest care employed to secure a good distribution of the dust.

3. A third method that may be employed if desired is to apply a heavy lime wash to the trees when the buds are swelling, but before they have burst. The best time is when they just begin to show an indication of green at the tips. This wash is made as follows:

Lime	100 lbs.
Salt	20 lbs.
Water	100 gals.

This has to be applied with the greatest care so as to cover the smallest twig, in order to enclose the eggs deposited thereon in a firm coat of whitewash. The best results can only be obtained by making two applications, the second as soon as the first has dried.

If carefully done this method has several advantages, in that the insects are destroyed before they have done any damage and there is not the same danger of spray injury as is encountered later. On the other hand, there are several disadvantages. It is impossible to get on heavy clay land with the heavy spray outfit at this time of the year. Furthermore, the great care necessary to cover the smallest twigs and the large amount of liquid required to do good work makes the task quite a formidable one. For those who are able to carry out this method and are willing to take the requisite pains, it will give satisfactory results.

ACCREDITED HERDS OF CANADIAN OXEN.

522 Herds Undergoing Tuberculin Test End of July.

Ottawa, Aug. 16. — The accredited herd plan for the elimination of bovine tuberculosis, which was initiated in the United States four years ago and was started in Canada two years later by the Department of Agriculture, has made remarkable progress. In this country at the end of July last, 522 herds were undergoing the tuberculin test at the hands of the veterinary officers of the Health of Animals Branch of the Department. New herds are being placed under test as rapidly as possible, but the applications are so numerous as to exceed the power of the staff to handle them.

At the end of July, 36,302 tests and retests had been made and 3,319 reactors had been condemned, the amount of compensation allowed reaching $396,464.33. The average cost of work per herd has been $725.00. The extent of the work in the United States will be appreciated when it is stated that the amount voted by Congress this year for compensation and salaries is five million dollars.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

There has never been a time in the history of the C. S. T. A. when those who were directing its operations could safely say that it was not confronted with any difficulty and that it was in a prosperous and thriving condition. From the very beginning difficulties and obstacles have constantly presented themselves, and in the solution of these problems — which at times seemed impossible of solution — the organization has gained experience and acquired strength. The result is that today we have a well organized body of six hundred members, thirteen local branches and, finally, a Society-owned magazine.

At the time of writing the successful operation of the C. S. T. A. appears to be beset with new and astoundingly serious difficulties. And yet anyone who calmly studies the prospects ahead of the organization, who carefully reads the opinions of prominent members and who takes for granted a Dominion-wide member--interest, cannot become discouraged or pessimistic.

How is the member-interest to be sustained? Obviously the most direct method is through the columns of the official organ, and that method should be encouraged. If *Scientific Agriculture* is not to provide a medium for free and frank expressions of opinion among the members, upon questions of mutual interest, then one of the main purposes of an official organ is removed. The various local branches should encourage, among their members, the use of their official organ as a channel through which questions of common — or even local — interest may be discussed by their fellow members in other parts of the country. That is the basic element essential to progress.

Once the member-interest is created, the period of serious difficulties is past. It is then possible to create direct interest and personal co-operation between the local branches, the various committees, the Editorial Board and the Dominion Executive. Such questions as finances, articles, circulation, advertising, new members, and so forth, will be a matter of common interest and concern. That is the ideal towards which we are aiming and it is confidence in the attainment of that ideal that obliterates any discouragement that might otherwise be felt when new difficulties present themselves.

In a word, the C. S. T. A. is now in a position to move forward, to prosper and to perform new service. The members of the Dominion Executive have sent that message forward to the local branches, and in course of time it will reach every member and every prospective member.

BUREAU OF RECORDS.

Plans are now being developed for the establishment in the office of the General Secretary of the Bureau of Records which was proposed at the Winnipeg Convention. A questionnaire is being drawn up with which every member will be furnished, and which will give the information necessary for the successful operation of the Bureau. Before this questionnaire is sent out it will be referred to the members of the Dominion Executive and to the local branch Executives, so that every opportunity may be provided for suggestions, changes and additions.

There is already some misunderstanding as to the purpose of the Bureau of Records; some have hinted that it savours somewhat of an "Employment Bureau", or a "clearing house" between the employers of technically trained men and the men themselves. It was never the intention of those who introduced the question at Winnipeg, that the Bureau should so function. The purpose of the Bureau is to provide first of all a complete indexed record of each and every member of the Society — his training, experience, and general qualifications—and to have that information classified and used, either as a record or made available to those seeking

professional agriculturists. Its main purpose is to provide a record which at present is greatly needed in this country and which is already provided in a number of other well organized professions.

No member is obliged to furnish all the information asked for in the questionnaire that is going to be sent out. Only such information need be furnished as the individual member is willing to place on record. But if every member looks upon the establishment of a Bureau of Records in the proper light, and appreciates its value to the agricultural industry, the information obtained will be of a very complete nature.

THE MONTREAL CONVENTION.

In order that plans for the 1922 Convention may be made well in advance, it would be helpful if members would make suggestions as to the nature of the programme, questions to be discussed, etc. It has already been suggested that the programme cover four days, that one day be devoted to a motor tour from Montreal to Quebec City and that an evening session be held at Quebec, that the general convention divide itself into groups for a consideration of their own particular problems, and that such groups organize themselves into Dominion-wide sections of the parent Society—agronomy, animal husbandry, horticulture, etc.

The dates proposed for the Convention are June 20th to 23rd inclusive, but no definite dates will be decided upon for some time.

Further suggestions from members will be appreciated.

CERTIFICATES OF MEMBERSHIP.

Within the past two weeks every member who was in good standing on May 31st has been furnished with a certificate of membership.

Members who joined the Society on and after August 15, 1920, have also been furnished with an Annual Membership Card, to be attached to the Certificate. Members who joined prior to August 15th will receive their membership cards upon payment of their annual dues for the ensuing twelve months. There are over four hundred of such members, and the fees are being solicited and collected by the Secretaries of the various local branches. Prompt payment will expedite the receipt by every member of his Annual Membership Card, without which the Certificate is not valid.

APPLICATIONS FOR MEMBERSHIP.

During the period between July 1st and August 15th the following applications for regular membership have been accepted:

E. R. Buckell, Cambridge, 1911, B.A., Vernon, B. C.

C. S. Chapman, Manitoba, 1921, B.S.A., Fort Qu'Appelle, Sask.

L. H. Hamilton, Toronto, 1920, B.S.A., Macdonald College, P. Q.

A. L. Hay, McGill, 1921, B.S.A., Fredericton, N. B.

D. A. Kimball, Toronto, 1920, B.S.A., Vineland Station, Ont.

J. A. Leclerc, Laval, 1920, B.S.A., Hull, P. Q.

W. W. Lee, London, Eng., 1902, B.A., 12 Arthur St., Ottawa, Ont.

J. B. MacCurry, Toronto, 1918, B.S.A., Charlottetown, P.E.I.

Margaret Newton, McGill, 1918, B.S.A., Saskatoon, Sask.

R. G. Newton, Toronto, 1918, B.S.A., Invermere, B. C.

R. C. Palmer, B. C. 1921, B.S.A., Cowichan Bay, B. C.

W. A. Shoults, Ont. Vet. Coll., 1892, V. S., Winnipeg, Man.

F. L. Wood, Toronto, 1921, B.S.A., Fredericton, N. B.

C. W. Traves, B. C., 1921, B.S.A., Grand Forks, B. C.

Ben Hoy, Toronto, 1909, B.S.A., Naramata, B. C.

Miss M. J. Mounce, B. C., 1921, B.S.A., University of B. C., Vancouver.

The following have been accepted as Associate Members:

Geo. Batho, Dept. of Agriculture, Winnipeg, Man.

T. H. Tweltridge, c-o Harris MacFayden Seed Co., Winnipeg, Man.

The addition of these names raises the total membership of the Society to 591.

CHANGES IN ADDRESSES.

The following changes in the addresses of members should be noted:

I. T. Barnet, Central Building, Victoria, B. C.

H. G. Bell, 14 Manning Arcade, Toronto, Ont.

Jas. Bremner, Jr., Moncton, N. B.

R. C. Elder, Canfield, Ont.

D. B. Flewelling, Box 836, Fredericton, N. B.

F. L. Goodman, Court House, Vernon, B. C.

E. C. Hatch, Gardenvale, P. Q.

J. H. King, Dept. of Agriculture, Fredericton, N. B.

A. J. Logsdail, Agricultural School, Kemptville, Ont.

C. Lyster, 4318 St. Catherine St. W., Montreal, P. Q.

H. H. McIntyre, Meadows, Man.

W. R. Shaw, Gardenvale, P. Q.

Lionel Stevenson, Dept. of Agriculture, Toronto, Ont.

E. M. Straight, Exp. Farm, Turgoose, Vancouver Island, B. C.

J. N. Timms, 616 Chatham St., Windsor, Ont.

R. C. Treherne, Entomological Branch, Ottawa, Ont.

THE A. A. A. S. CONVENTION.

For the first time in over thirty years a Convention of the American Association for the Advancement of Science is being held in Canada. The 1921 Convention (fiscal year 1922) will meet in Toronto from December 27th to December 31st next, the probable attendance being at last 3,000 members.

At the Winnipeg Convention of the C. S. T. A., the names of Dr. J. M. Swaine and Mr. Geo. E. Sanders were proposed to represent the Society at the A. A. A. S. Convention.

The Permanent Secretary of the Association is now awaiting a formal application from the C. S. T. A., seeking affiliation. If this application, now being considered by the Dominion Executive of the C. S. T. A., is favourably received by the Council of the Association, this new Canadian organization will have taken its place among the recognized scientific societies of America.

The meeting in Toronto should be of particular interest to members of the C. S. T. A. and as many as possible should arrange to be present. Arrangements are now being made with the Secretary of the Section on Agriculture, whereby consideration will be given in drawing up the programme, to topics and speakers suggested by the C. S. T. A., as being of special interest on such an occasion.

HONORARY SECRETARY MARRIES.

Mr. L. H. Newman, Honorary Secretary of the Canadian Society of Technical Agriculturists and Secretary of the Canadian Seed Growers' Association was married at Guelph, Ontario, on August 12th to Gertrude Kate Robinson, daughter of Mr. and Mrs. E. F. Robinson. Mr. and Mrs. Newman will reside in Ottawa after December 1st next.

Mr. Newman is a graduate of the Ontario Agricultural College (1903) and has been a prominent and interested promoter of the C. S. T. A. since its inception, both as a member of the Dominion Executive and of the Eastern Ontario local branch. The congratulations and good wishes of his many friends and co-workers in agriculture are extended to him and his bride.

The following matters should be constantly borne in mind, and brought to the attention of members whenever possible:

1. The C. S. T. A. is the owner of Scientific Agriculture and receives all revenue from subscriptions and advertising.

2. Circulation is the biggest argument in obtaining advertising, and a united effort by the branches will produce the desired results.

3. Communicate with the General Secretary as often as possible, and be sure to send a report of all meetings held. News items concerning members are always of interest.

4. Suitable articles for Scientific Agriculture can always be used.

5. Talk about the C. S. T. A. and the magazine to prospective members, subscribers and advertisers.

Canadian Society of Technical Agriculturists

CONSTITUTION AND BY-LAWS

(As Amended at the First Annual Convention, 1921.)

CONSTITUTION.

ARTICLE 1.

Name.

The organization shall be known as the Canadian Society of Technical Agriculturists.

ARTICLE 2.

Objects.

The objects of the Society shall be the following:

(a) To organize and unite all workers in scientific and technical agriculture, so that they may combine effort to promote the scientific and practical efficiency of the profession and to make the profession of increasing service to the agricultural industry.

(b) To maintain high standards in the profession.

(c) To encourage a national policy of agricultural research.

(d) To help to procure for scientific work in agriculture greater financial support and wider fields of usefulness.

(e) To aid in securing and maintaining a closer co-operation among all workers engaged in the profession of agriculture in Canada, and the better co-ordination of their work.

(f) To aid in bringing about a closer co-ordination between the profession as an organized body and the various agricultural associations throughout Canada.

(g) To serve as a medium where progressive ideas for improvements in agricultural education, investigation, publicity and extension work can be discussed, formulated and recommended for adoption when deemed advisable.

(h) To aid in ensuring the employment of technical men for technical positions.

(i) To issue publications in the interests of Agricultural science.

ARTICLE 3.

Membership.

There shall be three classes of members regular, associate and honorary.

1. A regular member must be
   (a) a graduate in agriculture from a university or college of recognized standing or
   (b) a graduate of a university or college who is engaged primarily in agricultural research, administration, education, extension work, publicity, experimental problems or other forms of allied work of a scientific or managerial nature, or
   (c) a non-graduate who is engaged primarily in agricultural research, administration, education, extension work, publicity or experimental problems and be accepted as provided for in the by-laws.

2. Associate membership shall be open to those engaged primarily in agricultural research, administration, education, extension work, publicity or experimental problems who are not at the time eligible for regular membership, and to the undergraduates of agricultural colleges. Members of this class must be accepted by the Dominion Executive. They shall have no voting powers.

3. The Honorary members' class shall be composed of persons not eligible for regular membership who have rendered the profession valuable or special service. They shall be selected as provided for in the by-laws.

4. From the regular members there shall be chosen a body of "Fellows," not exceeding thirty in number. The title "Fellow" shall be granted for professional distinction only, and be bestowed as provided for in the by-laws.

ARTICLE 4.

Officers.

The officers of the Society shall be a president, first and second vice-president, and honorary secretary-treasurer, who, together with one member of each provincial executive, shall form the Dominion Executive of the Society.

ARTICLE 5.

Organization.

The organization of the Society shall be:

(a) The Dominion Executive, consisting of the officers and members provided for in Article 4.

(b) The Provincial Executives.

(c) The Local Branch Executives.

ARTICLE 6.

Management.

The affairs and business of the Society shall be managed by such officers and committees and under such restrictions relating to the duties and powers of such officers and committees as may be provided for in the by-laws, such by-laws to make provision for the employment of a paid General Secretary-Treasurer.

ARTICLE 7.

Meetings.

There shall be an annual Convention of the Society and this shall be held alternately in Eastern and Western Canada.

Meetings of the Dominion Executive or meetings called by it shall be arranged as may be necessary to carry out the objects of the Society, where not specified in the by-laws.

Local organizations may hold meetings as provided for in the by-laws.

QUORUMS.—One-third of the members of the Dominion Executive or of any branch Executive shall constitute a quorum for the transaction of business, and at any meeting of any branch one-fifth of the enrolled members shall be considered a quorum for business or other purposes.

Place of Meeting. Each Annual Convention shall fix the place of meeting of the next Convention or shall delegate this duty to the Dominion Executive.

ARTICLE 8.

Fees.

The amount, apportionment, and method of collection, of the annual dues shall be regulated by By-law.

ARTICLE 9.

Elections.

The four main officers of the Society shall be elected at large as provided in the By-laws. All officers shall be eligible for re-election. Vacancies shall be filled by appointment by the Dominion Executive or by nomination and election at any regular or special convention.

ARTICLE 10.

Order of Business.

The order of business at all Conventions of the Society or meetings of the Dominion Executive shall be as follows:—

(a) Minutes.
(b) Business arising out of the minutes.
(c) Correspondence.
(d) Reports of Committees.
(e) Unfinished Business.
(f) Election of Officers and Committees.
(g) New Business.
(h) Resolutions.

This order may be varied at any meeting by a two-thirds vote of the delegates present.

ARTICLE 11.

Standing Committees.

Within one month from the date of the Annual Convention the Dominion Executive shall appoint any Special or Standing Committees of the Society as required by By-law. Nominations for such Committees may be made by any members or by the Nomination Committee at the date of the Annual Convention.

ARTICLE 12.

Changes of Constitution.

This Constitution may be amended at any Convention of the Society by unanimous vote or by a majority vote at two consecutive conventions.

By-Laws

ARTICLE I.

Membership.

1. The Society is Canadian, but Canadians resident in other countries are eligible for regular membership. Citizens of foreign countries are eligible for honorary membership.

2. Applications for regular membership must be made in writing to the Secretary of the Local Branch or the General-Secretary, for recommendation to the Membership Committee of the Dominion Executive.

3. "Fellowships" are granted upon recommendations made by the Dominion Executive or a subcommittee of that body, after such recommendations have been passed upon and confirmed by a two-thirds vote of the delegates at any annual convention. Any regular member may make recommendation for a fellowship through the prescribed channels.

It shall be provided however that until all the vacant "fellowships" are filled, not more than 5 may be appointed at any one Annual Convention.

4. Honorary members may be elected upon nomination by the Dominion Executive at any Annual Convention after acceptance by a two-thirds vote of the delegates.

5. Members, who in the opinion of the Dominion Executive have failed to maintain the dignity of the profession may be recommended for suspension by that body, but such recommendation, before being put into effect, will require to be substantiated by a two-thirds vote of the delegates present at the next Annual Convention.

ARTICLE II.

Duties of Officers.

The President and other officers shall perform the usual duties of their respective offices. The President shall also deliver an address at each Annual Convention.

ARTICLE III.

Organization.

1. Hereafter, no one shall be eligible for the Dominion Executive who has not been a member of the Society for one year.

2. The Dominion Executive shall be the business body of the Society and as such shall transact all general business of the organization. It shall appoint the General Secretary-Treasurer, who shall receive a salary to be decided on by itself.

It shall be responsible that all Standing Committees function in a manner satisfactory to the best interests of the Society.

3. Upon the application of 20 members, the Dominion Executive may permit the formation of a Local Branch providing, however, that there shall be at least one Local Branch in each Province, irrespective of the number of members in that Province. Such locals shall be governed by Constitution and By-laws formed in general after the Constitution and By-laws of this Society. A copy of each local and Provincial Constitution shall be sent to the Dominion Executive, which must approve it before it is valid.

4. Where there are two or more locals in any Province, these Locals shall form a Provincial Executive through which all dealings with the Dominion Executive must be conducted. The first Provincial Executive shall consist of the President, Vice-President and Secretary-Treasurer of each Local and shall proceed to effect the organization of their own Province.

ARTICLE IV.

Meetings.

1. The fiscal year of the Society shall commence on June 1st of each year, and the Annual Convention shall be held as soon thereafter as is deemed advisable by the Dominion Executive Committee.. It shall be convened in such city as may be decided upon at the preceding Annual Convention.

2. Each Local Branch shall be entitled to send one delegate for every 20 members and any majority fraction of 20 members.

3. Except where otherwise specified in the By-laws, all voting at conventions is reserved for official delegates.

4. The Dominion Executive may call such other conventions of the Society as may be necessary to carry on efficient work.

5. Local Branches shall hold meetings as arranged by their Executives.

6. The Dominion Executive shall meet when and where they may decide.

7. Notification of the place and date of the Annual Convention shall be sent by mail to each Provincial Executive at least two months before it is to be held.

Notification of the place and date of Provincial Executive Meetings shall be according to their own By-laws.

Notification of the place and date of Dominion Executive Meetings shall be sent by mail to each member of the Executive at least one (1) month before it is to be held together with agenda of business to be considered, apart from that of a routine nature.

ARTICLE V.

Fees.

The membership fees shall be $10.00 per annum of which $2.00 shall go to the Local Branch. The fee shall be payable either to the Local Secretary or to the general Secretary.

ARTICLE VI.

Funds.

Funds for the purpose of the Society may be raised by assessment upon each regular member by the Finance Committee, provided that a four-fifths affirmative vote of the registered delegates at any Annual Convention shall be obtained.

ARTICLE VII.

Elections.

1. Nominations for President, two Vice-Presidents and Honorary Secretary-Treasurer shall be valid if received by the Secretary of the Dominion Executive on or before March 31st, provided they are signed by 10 regular members in good standing.

2. The election of these officers shall be conducted on the Proportional Representation System, and shall be by mail ballot, every regular member in good standing shall be entitled to cast one ballot which shall be sent out by the General Secretary not later than April 10th, and these shall be counted by a Committee consisting of the General Secretary, one member of the Dominion Executive and a third party, not a member of the Society, who shall be selected by the Dominion Executive.

3. When the ballots for the Annual election of officers are being counted ,if the First Vice-President elected be English-speaking, only the French-speaking candidates shall be considered for the position of Second Vice-President, or vice versa.

4. All ballots shall be the regular form of ballot used by the Proportional Representation Society of Canada. These shall be supplied together with one "voting envelope" and one "identification envelope." On the face of the "voting envelope" the following shall be printed:—

(a) "Do not write anything on this envelope."

(b) "After marking your ballot enclose it in this envelope and seal."

(c) "Put this envelope (your ballot envelope) into the identification envelope."

(d) "Write your name and address plainly on the upper left-hand corner of the identification envelope."

(e) "Return your ballot enclosed in the two envelopes to the General Secretary."

ARTICLE VIII.

Committees.

1. The Committees of this Society shall be:—

(a) On Membership.

(b) On Finance.

(c) On Progress.

Which shall be sub-committees of the Dominion Executive.

(d) Research.

Which shall be Standing Committees, together with such others as may be deemed necessary.

(e) On Conventions.

Which shall be appointed by the Dominion Executive.

(f) On Resolutions.

(g) On Nominations.

Which shall be nominated and elected by and for each Convention, together with such other temporary committees as may be necessary for the efficient working of the Convention.

(h) Such permanent committee as may be appointed by each Convention to act upon its decisions.

2. The personnel of the Standing Committees shall be reviewed by the Committee on Nominations at each Annual Convention, which committee shall make recommendations for re-appointments and reorganization of all Standing Committees. Other committees shall be elected at each Annual Convention, or shall be appointed by the Dominion Executive.

3. It shall be customary, but not obligatory, that the Chairman of each Standing Committee shall be a member of the Dominion Executive. Each Committee shall consist of at least three members with power to add to their number.

4. The duties of the Committees shall be as follows:

(a) The Membership Committee shall receive, consider and pass upon all applications for membership and resignations of membership. It shall have power on behalf of the Society to deal finally with same. At its discretion it may delegate that power to the Dominion Executive.

(b) The Progress Committee shall devise means for stimulating the interest of the members in the work of the Society and shall actively interest itself in securing new members and new locals. It shall consider new plans and policies for the Society.

(c) The Research Committee shall investigate the possibilities for research work by the members of the Society.

ARTICLE IX.

Editorial Board.

An Editorial Board shall be appointed by the Dominion Executive which shall consist of two members from each Division of Agriculture, one member to retire each year from each division, the retiring member to be eligible for re-appointment.

The duties of the Editorial Board shall be to assist the Editor of the official organ of the Society in reviewing articles submitted for publication and in passing upon the merits of the same, and to also assist in collecting articles suitable for publication.

ARTICLE X.

Auditors.

Auditors shall be appointed each year at the Annual Convention, whose duty it shall be to audit the books of the Society, to certify to the correctness of same, and to undertake any further work attached to the work of auditing the accounts of the Society.

ARTICLE XI.

Amendments to By-Laws.

The By-laws of this Society may be amended or added to by a majority vote of the delegates present at the Annual Convention or by a four-fifths majority of the members of the Dominion Executive subject to approval at the next Convention;

Provided that, in the first case, notification of the proposed amendment is sent to the General Secretary before May 1st.

The General Secretary shall forward copies of all proposed amendments to the Secretary-Treasurer of each Provincial Executive.

LA REVUE AGRONOMIQUE

L'exécutif de la Société a pris récemment une décision importante au sujet de la publication de la Revue agronomique canadienne.

A son retour de Winnipeg, le 21 juin dernier, le Secrétaire général fut averti que l'éditeur de notre organe était forcé de suspendre la publication de la revue jusqu'à janvier 1922 à cause du peu de revenu qu'il en retirait. Le premier vice-président et le secrétaire général, comprenant qu'un tel contre-temps était de nature à nuire au progrès de la Société, essayèrent de trouver une solution à la difficulté. A cette fin, ils eurent plusieurs entrevues avec l'éditeur et après avoir minutieusement étudié la question, ils en vinrent finalement à cette décision approuvée par l'exécutif. La publication de la Revue agronomique relève maintenant directement de la Société en ce sens que les revenus, souscriptions ou annonces, seront au crédit de la Société qui, d'autre part, aura à rencontrer les dépenses qu'entraînent l'impression et la publication.

En concluant cet arrangement, la direction se rend compte de la responsabilité qu'elle assume. Elle est convaincue cependant que la Revue a sa place chez l'abonné, qu'elle est utile à l'annonceur et nécessaire à la Société.

Nous espérons que cette nouvelle politique rencontrera l'assentiment de tous les membres et que chacun d'eux se fera un devoir de promouvoir les intérêts de notre organe.

Important

Les trois points suivants demandent l'immédiate et sérieuse considération de chacun des membres de la Société:

Etat Financier

Le 31 juillet dernier, la Société avait besoin de la somme de $1,200 pour payer ses dettes, contractées surtout durant le mois de juin, lors de la convention générale. Les cotisations dues le premier juin eussent-elles été payées à temps que la Société eût eu à cette époque au moins $1,800.00 dans sa caisse. L'état financier de la Société n'est donc pas présentement excessivement brillant. Ce n'est cependant qu'un retard. Les contributions annuelles qui commencent à pleuvoir remettront la Société en bonne posture.

Abonnements

La Société est maintenant propriétaire de la Revue agronomique. Elle voudrait en faire un succès. Elle compte pour cela sur des abonnés nouveaux. Or, cette campagne ne saurait être entreprise par d'autres que par les membres. Ils mettront donc tous l'épaule à la roue.

Annonces

Les abonnements ne seront pas suffisants pour permettre à la Société de faire un succès de sa Revue. Il lui faut des annonces — elle en aura d'autant plus que la circulation sera plus grande — et ici encore elle fait appel à ses membres. Plusieurs d'entre eux connaissent, soit des producteurs, soit des industriels, soit des commerçants, qui, s'ils connaissaient la Société, signeraient avec elle des contrats avantageux. Que chaque membre donc se fasse un devoir de mettre des annonceurs en relation avec M. Grindley, de Gardenvale, P. Q.—F. L.

C'est maintenant le temps, pour un certain nombre de membres — ceux qui ont remarqué au bas de notre dernière circulaire une note à la plume — de renouveler leur cotisation annuelle. Plusieurs, déjà, l'ont fait. Nous les remercions.

La Solution du Problème de l'Azote

Par H.-M. Nagant, I.A., I.F., professeur
à l'Institut d'Oka.

ESSAIS AUX ETATS-UNIS

(Suite des numéros d'avril, mai et juin)

Aux Etats-Unis, on en était encore à la période des tâtonnements, vers la fin de la guerre, dans l'usine expérimentale montée par le "Bureau of Soils" à son laboratoire d'Arlington.

On aura d'ailleurs une idée du problème technique résolu par la "Badische" en lisant les quelques notes suivantes, empruntées d'une conférence faite, sur l'application aux Etats-Unis du procédé Haber à la 55e assemblée de la "American Chemical Society" tenue en Steptembre 1917 à Boston, par messieurs R. O. F. Davis et Harry Bryan, tous deux du "Bureau of Soils" de Washington.

"'Opérer à haute pression et à une température relativement élevée, conditions qui rendent corrosif un gaz ordinairement inerte comme l'hydrogne, comporte bien des difficultés.

La destruction occasionnelle d'usines expérimentales, par suite d'explosions, provoqua de la timidité chez les ouvriers, comme chez les chimistes. Les Allemands ont affirmé que si une équipe d'ouvriers devait être perdue, il faudrait trois ans pour en dresser une nouvelle aux opérations de détail des installations. Ce fut avec quelque hésitation que nous entreprîmes une étude du procédé au début de cette année."

Voici quelques données sur l'installation expérimentale montée par le "Bureau of Soils". Comme chambre de réaction on employa d'abord un obus de 8 pouces fourni par le Département de la marine, ensuite un cylindre en acier, entouré d'un coussin d'eau, et doublé intérieurement d'un tube en quartz agissant comme calorifuge et empêchant l'action corrosive de l'hydrogène, sous pression à 500° sur l'acier du cylindre. On eut des difficultés à se procurer les matériaux requis pour construire l'appareil; toutes les pièces employées furent préalablement éprouvées à une pression de 5,000 lbs. par pouce carré.

D'autres problèmes à résoudre furent la diffusion de l'hydrogène à travers le métal chauffé, la conductibilité thermique des gaz comprimés, la construction de joints étanches, etc. L'hydrogène et l'azote employés doivent être bien purs afin de ne pas altérer l'agent catalytique.

Application des hyperpressions au procédé Haber.

C'est presque devenu un cliché de dire que le génie français fait les inventions, tandis que la méthode allemande en réalise les perfectionnements et l'adaptation pratique.

Pour une fois, du moins, il semble y avoir exception à la règle et renversement des rôles, puisque nous voyons un savant français, du nom de Georges Claude apporter une modification au procédé Haber, destinée à en augmenter l'efficacité dans une mesure très étendue; il s'agit des applications des hyperpressions.

Dans les fameux appareils construits par la "Badische", on comprime le mélange d'azote et d'hydrogène jusqu'à 250 atmosphères, fait qui aura déjà de la stupéfaction dans les milieux industriels; or Gearges Claude est parvenu à construire un compresseur atteignant directement 1,000 atmosphères, et cela avec une facilité et une perfection telles que l'inventeur peut le faire fonctionner, en guise de démonstration, à une conférence publique.

Le premier grand avantage de cette pression prodigieuse est le rendement beaucoup plus considérable et plus économique. En effet, alors qu'à 250 atmosphères la teneur en NH_3 des gaz comprimés en présence du catalyseur atteint au maximum 13 pour cent, elle monte à plus de 40 pour cent, lorsque la pression atteint 1,000 atmosphères.

D'autres parts, Georges Claude dans un article publié dans la grande revue française "Chimie et Industrie" (juillet 1920) où il fait lui-même un exposé magistral de sa méthode nous démontre encore une foule

d'autres avantages qu'elle possède sur celle de Haber.

Il serait trop long de les discuter ici; aussi nous nous contenterons de signaler seulement la grande réduction de volume des appareils corrélativement à l'augmentation des pressions. Il en résulte qu'avec des installations beaucoup plus petites que les monstrueuses usines d'Oppau, si bien dans le goût du "Kolossal" allemand on obtiendra des résultats équivalents.

Suivant l'inventeur, la difficulté de construction des appareils à compression, à partir d'une certaine pression, au lieu de croître diminue plutôt avec l'augmentation de celle-ci, et cela à cause de la réduction en volume des appareils. Comme le fait remarquer l'ingénieur français, les joints, qui sont surtout les parties délicates, sont plus petits et donc plus facilement étanches pour les petits compresseurs à hyperpression que chez les appareils plus grands nécessaires aux pressions moyennes.

Enfin le plus éclatant témoignage en faveur du système des hyperpressions prôné par Georges Claude c'est son adoption dans les principaux pays où se fondent actuellement de puissantes sociétés pour la fabrication synthétique de l'ammoniaque.

C'est ainsi que l'"American Fertilizer" (juillet 1920) annonce qu'une compagnie anglaise, la Cumberland Coal Power and Chemicals Limited, a acquis les droits du procédé Claude en Angleterre. Elle se propose de débuter par une première usine possédant une capacité productive de 50,000 tonnes de sulfate d'ammoniaque par an.

Intervention des gouvernements pour stimuler l'industrie des produits azotés synthétiques.

L'Allemagne consciente de l'importance primordiale qu'avait pour elle une organisation formidable de son industrie des produits azotés, non seulement au point de vue des besoins urgents actuels en explosifs, mais encore pour le maintien et le développement futur de son agriculture, n'attendit pas le prolongement, non escompté d'ailleurs, des hostilités, pour la stimuler et l'asseoir sur des bases solides et permanentes. Dès le début de 1915, le gouvernement allemand fit voter une loi par le "Bundesrath", (conseil fédéral) établissant un monopole d'état sur les produits azotés, restant effectif jusqu'en 1922. Ce monopole avait pour but, en premier lieu d'attirer une grande mise de fonds dans l'édification d'une puissante industrie nationale de ces produits, basée sur les recherches des savants allemands; ensuite, de protéger, d'assurer le maintien de cette industrie dans les circonstances difficiles qu'elle serait exposée à traverser sans cela, par le rétablissement de la concurrence des produits azotés naturels et la diminution momentanée de la demande, après la guerre. La 2me partie de ce programme sera sans doute calquée sur l'organisation du fameux "Kalisyndikat" qui a si bien réussi à rendre florissante l'industrie de la potasse sous la régie d'un monopole d'état.

Le Congrès des Etats-Unis s'est un peu inspiré de l'exemple de l'Allemagne en établissant la *Commission* dite *"de l'approvisionnement des nitrates"* comprenant des officiers de l'armée et de la marine, des délégués du "Bureau of Soils" du "Bureau of Standards" du "Bureau of Mines" et des savants divers. En prévision de l'éventualité possible de ne pas disposer du salpêtre du Chili, et pour se soustraire à cette dépendance d'un pays étranger, le *National Defence Act* a chargé cette commission de recherche les moyens les meilleurs, les plus économiques et les plus pratiques, pour la production des nitrates et autres produits nécessaires pour les munitions de guerre et utiles pour la fabrication des engrais.

Parmi les recommandations générales, édictées par ladite Commission, en date du 11 mai 1917, figurent une attribution de 3,000,000 de dollars, pris sur le crédit général de 20,000,000 qui fut voté, pour l'érection d'une fabrique d'ammoniaque synthétique, suivant le procédé adopté par la *General Chemical Company*, d'une capacité productive de 60,000 lbs. de NH_3 par 24 heures. Une autre somme de 600,000 dollars est mise à la disposition du Département de la guerre, afin d'être employée à l'établissement d'une usine d'oxydation de NH_3 en acide nitrique, capable de produire 24,000 lbs. de cet acide par 24 heures.

Avenir pour les composés azotés synthétiques au Canada.

On considère à bon droit qu'une des grandes sources de récupération économique de l'Allemagne, vaincue et obligée de

réparer les dévastations sans non nom commises par ses hordes dans les régions envahies durant la guerre, sera son industrie des composés azotés, qui non seulement lui permet déjà de se passer des importations de nitrate de soude du Chili, dont elle consommait annuellement plus de 80,000 tonnes avant 1914, mais lui procurera encore un énorme commerce d'exportation, capable de rétablir graduellement son change déprécié.

Ceci n'est pas pour surprendre lorsqu'on considère seulement que de 100,000 tonnes, exprimée en azote pur, ou 500,000 à l'état de sulfate d'ammoniaque, la capacité de production des composés azotés, en 1914, est passée à 500,000 tonnes, en 1920, correspondant à 2,5000,000 tonnes de sulfate d'ammoniaque. (Chimie et Industrie, avril 1914).

Le Canada aussi est grevé d'une dette de guerre assez lourde, et éprouve le besoin d'exploiter avec plus d'intensité ses ressources naturelles dans le but d'alléger ce fardeau. Il est très riche en pouvoir d'eau, aussi bien dans les régions déjà habitées ou habitables que dans les territoires septentrionaux où le climat rigoureux et la topographie seront toujours des obstacles à la colonisation agricole. Des industries variées pourront se disputer l'énergie hydraulique dans les premières régions, mais l'éloignement et l'absence de matières premières sur place pour être transformées en produits manufacturés semblaient rendre à jamais inutilisables de puissantes chutes d'eau, comme celle de la rivière Hamilton située dans l'inhospitalier district de l'Ungava. Seule une industrie n'employant pas de matières premières pourrait s'y établir avec succès. La synthèse des composés azotés tels que l'ammoniaque et l'acide nitrique constitue cette industrie unique au monde puisqu'elle ne réclame que de l'air et de l'eau, matières premières distribuées sur toute la surface du globe. Aussi n'est-ce pas un vain rêve de prévoir que dans un avenir rapproché l'énergie perdue des rayons du soleil, qui luit trop faiblement dans l'Ungava pour y produire des récoltes, y sera captée et condensée sous forme de composés azotés puis ramenée, à cet état, vers le sud pour restaurer ou multiplier la fécondité des sols déjà plus ou moins épuisés des régions de Québec et d'Ontario. Il est certain, en effet, que nous avons là en puissance des centaines de mille tonnes de nitrate d'ammoniaque, susceptibles de devenir un produit d'exportation directe ou mieux encore d'être converties dans le pays même en matière végétale et animale.

Réflexion finale

Enfin clôturons cet essai sur le problème de l'azote, dont la guerre universelle a fait ressortir l'intérêt d'une façon plus saisissante que jamais par la réflexion suivante :

S'il faut déplorer que les progrès extraordinaires réalisés dans la fabrication industrielle des composés azotés synthétiques, que nous avons qualifiés de *conquête de l'azote atmosphérique,* aient permis à l'Allemagne de poursuivre pendant plus de quatre années ses projets de conquête mondiale, il nous reste au moins la consolation que voici : Cette guerre funeste qui a fait travailler bras et cerveaux pour construire des engins toujours plus meurtriers, pour imaginer des procédés toujours plus intensifs de destruction de la vie humaine, par un contraste d'une singulière ironie aura contribué par ses oeuvres de mort même, à assurer plus de pain, plus de vie aux générations futures, menacées d'en manquer. Car le million et demi ou deux millions de tonnes de composés azotés synthétiques, dont personne n'eût rêvé la production annuelle, il y a peu de temps, ne tarderont pas à devenir plusieurs millions lorsque le besoin s'en fera sntir, ils viendront remplacer, dans les sillons du cultivateur, l'humus qui diminue, le nitrate de soude qui s'épuise, suppléer au sulfate d'ammoniaque de récupération, toujours insuffisant, et à la restauration trop lente du capital *azote de circulation* par la culture méthodique du trèfle ou autres légumineuses.

Mais fasse la Miséricorde Divine, que rarement du moins, s'il n'est pas permis de se bercer d'illusions, les composés du nitre, appelés à faire plus drus et plus longs les épis de blé, à rendre plus lourdes de vie ses vagues qui ondulent, dorées, sous la brise, ne soient détournés de leur but par les ouragans de haine et de démence sortie de l'enfer, pour multiplier la mort et la hideuse destruction dans ces mêmes champs où ils devaient faire surgir l'opulente verdure, édifier la prospérité, dans la paix.

Reminiscences

Par Frère M. Liguori, Chef du Service
de l'Aviculture, Québec.

TENEBRES

Ante lucem.

C'était, pour parler comme les poètes, aux jours sombres de l'aurore du présent siècle. Au ministère de l'agriculture les titulaires — invariablement avocats — se succédaient avec une rapidité telle qu'elle trahissait franchement leur désir de profiter de la première occasion de dire adieu aux champs de patates et de blé-d'Inde. La loyale opposition de Sa Majesté—encore composée d'avocats—clamait comme d'habitude qu'il faisait bien noir dans les comptes publics, mais sans jamais se rendre compte que cette obscurité n'était que relative, comparée aux ténèbres que l'on pouvait trop souvent, hélas! constater en plein jour dans beaucoup de "bâtiments" où logeait le bétail de la Province.

Dans le demi-jour des étables-écuries du temps, qui servaient aussi et presqu'invariablement de basses-cours, on trouvait, non moins invariablement, des volailles au plumage terne, et de race... "que dans une langue on ne nomme," pour l'excellente raison qu'elles n'appartenaient à aucune race distincte.

Les troupeaux pur sang étaient alors une exception quasi luxueuse. Dans l'ordre aristocratique venaient ensuite ce que l'on appelait les "races améliorées" — Dieu sait comment — constituées de troupeaux auxquels on avait infusé généralement au petit bonheur et sans discrétion aucune, un sang étranger quelconque. La masse des troupeaux, acclimatés au pays depuis des siècles, valait encore mieux que les croisements illogiques auxquels on avait parfois recours.

A cette époque, le voyageur naïf ou inexpérimenté qui en novembre, décembre ou janvier, s'avisait de demander des oeufs frais dans une hôtellerie de la campagne passait lui-même pour un "beau frais!" On allait jusqu'à lui répondre, avec non moins de naïveté: "Des oeufs frais à cette saison! Vous n'y pensez pas! On n'est pas en ville ici!...

Tout comme si c'était le rôle de la ville de ravitailler la campagne en produits de la ferme!...

N'avais-je pas raison de dire qu'il faisait sombre au commencement du siècle dans notre aviculture; que la situation de notre industrie avicole n'était pas du tout ensoleillée.

Aurore!

En 1907 apparut "L'Action Sociale", depuis longtemps attendue. J'eus l'honneur de collaborer, des années durant, à sa page agricole, alors embryonnaire, mais que nos B. S. A. ont depuis transformé en une magnifique revue hebdomadaire des choses rurales, tout comme ils l'ont fait pour la page rurale de la plupart de nos quotidiens.

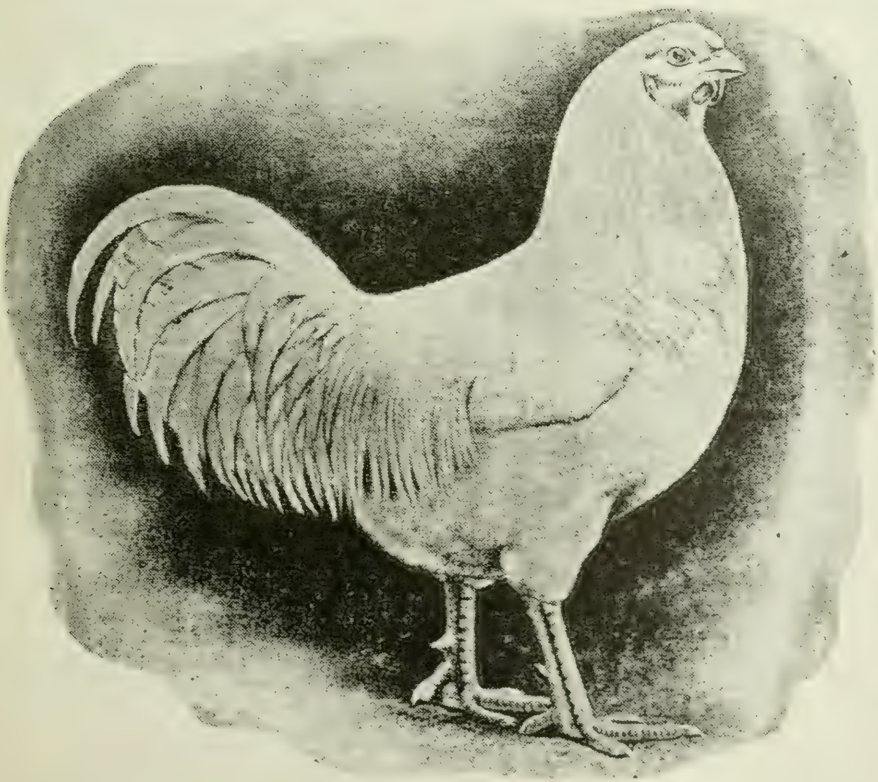
Servir du cru toutes les semaines, et non faire à coup de ciseaux le service agricole d'un grand journal, était à cette époque une innovation et une entreprise quasi téméraires. Evidemment cette page avait la vie dure, puisque je ne la tuai pas du coup.

J'y cultivai surtout l'aviculture, et servis chaud, tous les samedis, un article sur l'actualité avicole. On finit par me lire toutes les semaines, paraît-il, et bientôt je fus honoré d'une clientèle de lecteurs qui, pour n'être pas aussi nombreuse que la postérité d'Abraham, n'en était pas moins fidèle et fervente...en aviculture.

Vers 1909, je finis aussi par obtenir de l'un de ces ministres éphémères la somme de $25 (1) pour populariser le poulailler froid, l'éprouver ailleurs qu'à Oka, et... pour développer l'aviculture en général à travers la Province...en général. L'intelligente opposition de Sa Majesté, à qui je rends grâces, ne réclama pas d'enquête sur l'emploi possible de cette somme. Aussi, fort de mon $25; mais surtout de l'appui et du zèle de mes fidèles lecteurs de la

(1) Le typo est instamment prié d'aller faire ses coquilles ailleurs que dans mon $25. S'il savait seulement comme "j'en ai arraché" avant le le palper!

La Race Chanticler—la poule.



La Race Chanticler—le coq.

"Chronique Avicole", qui constituaient réellement une force morale appréciable, je me mis en campagne de concert avec ce pauvre Victor Fortier, ce loyal ami du peuple, disparu trop tôt. La Province doit à ce dernier, et à l'Institut Agricole d'Oka, l'érection des premiers poulaillers à façade en coton. Dès 1906 Fortier induisait les cultivateurs de St-Agapit, Lotbinière, à en construire quelques-uns. En 1909 nous organisions au même lieu une société pour la vente des oeufs en coopération. Encore une innovation!

Entre temps, l'honorable M. J. Allard, ministre de l'Agriculture, donnait à "L'Union Expérimentale des Agriculteurs de Québec", organisée sous l'administration de l'honorable J. Décarie, son existence légale. Son successeur, M. Caron, ne fut pas lent à deviner le rôle efficace que cette société pouvait jouer pour peu qu'il l'aidât dans ses oeuvres de propagande et d'enseignements. Et l'*Union* joua le rôle de précurseur de plusieurs des Services du Département de l'Agriculture, régulièrement organisés depuis.

Désormais je menai de front, pour quelques années du moins, la conférence, la "Chronique Avicole" de différentes publications, plus la construction à travers la Province de ces poulaillers "autonomes", sanitaires, hygiéniques, que le peuple, avec le bon sens qui le distingue, devait irrévocablement appeler "poulaillers froids."

"L'Action Sociale" édita et réédita dans le temps une brochure de propagande intitulée "Le diable est aux Vaches" et qui contribua, plus que beaucoup de froide littérature officielle ou technique, à attirer l'attention du paysan sur la nécessité de l'air pur et des rayons de soleil dans les bâtiments de ferme destinés à abriter soit le bétail soit les volatiles de la basse-cour. Tout cela contribuait à la diffusion des poulaillers remplis de soleil et d'air respirable.

En 1914 un service régulier d'Aviculture, faisant partie intégrante du Département de l'Agriculture, remplaça définitivement la section avicole de l'Union Expérimentale, qui en 1912 s'était déjà assuré les services — intermittents il est vrai — d'un spécialiste en aviculture, M. J.-G. Morgan, qui devint le premier instructeur avicole officiel dans la Province.

En pleine lumière!

Enfin les ténèbres, qui au commencement du siècle enveloppaient encore la question avicole, se sont dissipées; et l'avenir apparaît maintenant presque radieux.

Le peuple a accepté les poulaillers isolés ou poulaillers froids, il y transfère graduellement ses troupeaux de volailles qui, après trois siècles de cohabitation avec les vaches, les chevaux, etc., respirent enfin dans une atmosphère convenable et ensoleillée. Ca et là, dans des régions entières mêmes, on ne trouve guère maintenant que des troupeaux de races pures, tout au moins fortement améliorés par l'infusion d'un sang désirable. La production des oeufs et de la viande de volaille s'est considérablement accrue. L'amélioration de la qualité est encore plus notable.

La lecture des derniers rapports du ministre de l'Agriculture, les déclarations des grandes maisons de commerce avicole, tels la Société Coopérative Centrale des Agriculteurs de Québec, les établissements Gunn, Langlois et Cie, Swift, Poulin et Cie, etc., feront mieux toucher du doigt qu'enfin et malgré les circonstances adverses de la grande guerre, nous sommes désormais entrés, pour n'en plus sortir, dans le mouvement de l'aviculture progressive.

Les 15 associations avicoles de la Province ont récemment organisé une Association Provinciale, pour laquelle le Département de l'Agriculture a dépensé à date quelque $15,000.

80 et 50 pour cent des prix offerts par ces associations sont payés par le Département, suivant que les oiseaux primés appartiennent aux classes d'utilité ou d'agrément.

Le Département encourage aussi de ses deniers la construction de poulaillers, l'achat de puissants broyeurs d'os, la distribution d'oeufs de races pures aux écoliers et aux cercles de fermières, etc., etc. La popularité croissante de ces oeuvres diverses, de l'intérêt que porte aujourd'hui la population à l'élevage ratiomel de la volaille, alors qu'en 1900 le mot *aviculture* lui-même était à peine connu du peuple.

La dernière évolution à noter est la production et le commerce de poussins d'un jour, poussins éclos dans des incubateurs

géants, (Mammoth incubators) puis distribués aux clients à travers la Province. On compte aujourd'hui plusieurs de ces établissements progressifs, notamment à Princeville, St-François-du-Lac, Pierreville, St-Hyacinthe, Rougemont, Québec, Pointe-Gatineau, Knowlton, etc., etc. Ce dernier est spécialement affecté à la production du canard, le seul et le premier grand établissement industriel du genre au Canada, croyons-nous.

Pour couronner le tout, la Province de Québec, grâce à la basse-cour de l'Institut Agricole d'Oka, vient d'être dotée d'une race de création essentiellement canadienne et tout spécialement adoptée à nos conditions climatériques, la race Chantecler dont la popularité, au Canada comme aux Etats-Unis, s'accroit de jour en jour.

LA PRESSE

La presse d'enseignement et de direction, agricole et technique surtout, n'a rencontré jusqu'à ces derniers temps qu'un petits nombre de fervents. Et c'est pourtant à elle, autant qu'à l'enseignement verbal, que nous devons les progrès merveilleux par où notre province se classe au premier rang des grandes agriculturistes de l'Empire. N'allons pas l'oublier et ne dédaignons plus les services que la presse agricole nous a rendus et nous rendra.

Elle se diffuse sous des formes diverses et variées, journaux hebdomadaires, revues, et le reste. Et c'est heureux, car elle atteindra bientôt toutes les activités rurales et dirigera les mouvements parallèles aux intérêts spéciaux de ces activités, en mettant à leur service sa puissance irrésistible.

Nous en avons besoin de la presse pour défendre nos droits devant une politique qui tenterait de se faire autocrate. Nous en avons besoin pour attaquer des édifices pas trop nouveaux où l'on voudrait entraîner notre bonne foi, pour ensuite nous dépouiller de notre liberté d'action, et, si possible de nos argents. Nous en avons besoin pour démasquer le servilisme et l'intérêt personnel, qui sont une entrave à l'épanouissement d'oeuvres généreuses et nécessaires. Car la presse est une arme et un levier, et elle peut tout par son emprise, lente, mais certaine, sur les idées des peuples.

Alphonse Desilets.

QUEBEC

EXPOSITION PROVINCIALE

1921 3-10 SEPTEMBER 1921

Un programme sans précédent.

Huit jours de gloire pour l'Agriculture.

Le plus grand déploiement agricole de la province.

Participation intense du ministère provincial de l'Agriculture.

FETES OFFICIELLES DU MERITE AGRICOLE.

N'allez pas manquer ce grand rendez-vous annuel.

Service Provincial des Agronomes

Depuis l'automne 1913, le Ministère de l'Agriculture a inauguré, dans notre Province, un système de propagande et d'enseignement agricoles par le moyen d'agronomes de district.

Pour remplir la charge, l'aspirant doit avoir fait un cours complet d'agriculture et avoir obtenu, d'une institution autorisée, le diplome de "bachelier-ès-sciences agricoles" (B. S. A.) Il doit, de plus, avoir fait un stage comme assistant-agronome pendant lequel ses connaissances en agriculture et ses aptitudes à remplir la charge sont mises à l'épreuve.

Le travail de l'agronome est très étendu. Il doit visiter les cultivateurs pour leur fournir sur place les renseignements dont ils ont besoin; faire des conférences sur des sujets les plus divers; donner des démonstrations sur les façons culturales, l'abattage des volailles, la taille des arbres, etc.

Il doit organiser un bureau d'information agricole, préparer des articles pour les journaux locaux, recevoir les visiteurs, représenter les cultivateurs, etc.

Les bureaux d'agronomes sont munis de tout le matériel démonstratif usuel.

Les fonctions les plus importantes de l'agronome sont celles de l'organisation agricole. Il doit se rendre compte de l'état et du fonctionnement de chaque société d'agriculture, cercle agricole, société coopérative agricole, etc.; il doit, de plus, aider à l'organisation des expositions agricoles ou scolaires.

Nombre d'agronomes.	50
Nombre de sous-agronomes.	21
Nombre d'aide-sténographes.	25
Nombre de comtés déservis.	51

Bonus minimum voté par chaque comté $250.00.

SOMMAIRE DU TRAVAIL EXECUTE EN 1920

Conférences données	479
Démonstrations	1927
Expositions scolaires	83
Visites à domicile	622,248
Concours divers	80
Correspondance	33,570

Le Ministère de l'Agriculture de la Province de Québec

EDITORIAL

SUGGESTED CHANGE IN EDITORIAL POLICY.

In view of the fact that many of the subscribers to this magazine, as well as the majority of the members of the Canadian Society of Technical Agriculturists, are mainly engaged in agricultural work which cannot be considered as strictly technical, it has been proposed that articles be accepted and published which bear more directly upon the practical phases of the industry. In contemplating such a step, it is emphasized that such articles should not conflict with those already appearing in the agricultural press, but it is pointed out that there is a type of article which, while being more or less popular to the average reader, may be considered technical in its relationship to practical agriculture.

The matter has been referred to the publishers of the magazine, through the Dominion Executive Committee, and their judgment will be accepted and announced in the next issue. Expressions of opinion from the readers of the magazine are also desired.

The present issue is intended to represent the type of magazine under consideration. It includes a description of a new machine for the separation or cleaning of seed, the results of experimental work in fruit culture in Saskatchewan, an article on the production of cucumbers under glass, the first of a series of articles on diseases of the potato, a description of a new disease of sunflowers, and comparatively few articles that are strictly scientific. At the same time we believe that each of the articles published in the present issue represents a contribution to scientific agriculture, even if, in making that contribution, it takes a practical form.

The different fields of effort into which agriculture may be divided, as indicated in the personnel of the Editorial Board, add to the difficulty of covering the subject fully with a technical journal. In nearly every division the practical or commercial, as well as the technical or scientific, play an important part, although all may be considered to be scientific in their application.

To maintain the interest of every member of the Society, and every subscriber to the magazine, and at the same time produce a publication that is distinctive and non-competitive, is very difficult, but every possible effort will be made to do so. Above all we should try to ensure the sympathetic support of the agricultural press. We believe that *Scientific Agriculture* can be of great assistance in furthering the work which the agricultural press is doing, but the assistance should be supplementary or additional rather than a duplication of effort.

THE DEVELOPMENT OF DRY AREAS.

Lack of adequate moisture is the most serious obstacle to successful crop production and, *per contra*, abundant moisture is of far more benefit to a growing crop than any of the artificial methods employed to improve quality and yield. Any progress made towards the improvements of conditions or the introduction of new varieties in localities commonly known as "dry districts" will not only benefit the farmers in those districts but, by increasing the crop-producing areas of Canada, will be of great national importance.

It is estimated that there will be about 850,000 acres of fall planted rye in Southern Alberta and Western Saskatchewan this year, which represents an increase of 185 per cent over the acreage planted last year. Based on an average crop yield and present prices this represnts an increased revenue to the farmers in those districts of between three and four million dollars.

The agency responsible for this movement is the Western Canada Colonization Association which, in co-operation with other agencies, recently conducted an enquiry in the drouth-stricken areas of Saskatchewan and Alberta. The results of this enquiry and the steps taken to in-

crease the acreage planted to fall rye, are given in the following statement issued on September 12th:

"A hurried survey of the dry areas revealed the fact that fall planted rye does much better in a dry year than wheat. It yields from 25 to 50 per cent. more bushels per acre than wheat. Planted in the fall, it secures the fall and winter moisture, and ripens three weeks earlier than wheat, thus escaping the hot winds of late July. It is not injured by cutworms, does not rust, chokes weeds, and prevents soil drifting. As a result of this information, it was decided to carry on an energetic campaign to secure a greatly increased acreage of rye for the coming season.

"The countryside was placarded with posters, urging the advantages of rye planting, and indicating how the best kind of seed could be obtained, largely through the Federal and Provincial Governments. Tens of thousands of leaflets containing more elaborate information to the same end were distributed through the banks, the boards of trade and other agencies. It was ascertained that there would be a good market for any increased production of rye obtainable in Western Canada. Public meetings were held at various centres to secure the active co-operation of various interests. The farmers responded generally to the campaign. If this fall's increased planting of rye brings the expected monetary results next year, there will be a still further increased acreage under rye for 1923, and a great step will have been taken towards permanently improving the condition of the farmers throughout the dry areas of Southern Alberta and Western Saskatchewan."

SOME WRONG OPINIONS.

It appears to be true that every new movement, before it is soundly established and in a position to make progress, must have certain obstacles thrown in its way, as though the overcoming of such obstacles were a necessary part of its growth. It is probably also a truth that many worthy institutions have been too severely opposed by innocent public opinion and have ceased to function, often to the disappointment of the critics themselves.

Throughout the initial stages of its development the Canadian Society of Technical Agriculturists had to face many obstacles and answer many criticisms. There were none who doubted the advantages of such an organization but there were many who questioned the real motives that prompted its formation. Some there were who claimed that it was an outgrowth of Civil Service re-classification, others who hinted, fairly plainly, that it would promote the interests of certain favoured groups, and still others who merely sat back and said that such an organization could not possibly be effected.

And yet, in the face of these criticisms, the organization has made rapid growth, and has not at any time since its inception two years ago merited any of the criticisms which were levelled at it. Without doubt there were suggestions made, during the organization period, that were helpful, but now that the pioneer work has been completed, the Society needs staunch support more than any form of even the most friendly criticism. Ample opportunity will be provided for changes in the operating policy, but real usefulness will come from unity of effort in the conduct of any work that may be undertaken.

The Society at present appears to be firmly established but there are, in every section of Canada, a few eligible members who have not as yet made application for membership. This fact constitutes the only present obstacle to complete success, and it will be removed in course of time. There has been no justice for any criticism so far made. The organization is attempting nothing more than the bringing together of the technical workers in agriculture, the closer co-ordination of effort, the maintenance of high standards in the profession, the encouragement of agricultural research and the publication of material which is of interest and value to the student and worker in agriculture.

There can be no merited criticism made of such an organization and its progress towards the desired goal will be materially hastened when the proper volume of support is given to the movement.

The Relation of Pruning and Fertilization to Fruit Bud Formation

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Horticultural science is to-day making rapid strides in the solution of problems upon which light has long been wanting. Scientific research is unearthing a wealth of material, much of which offers practical solutions or at least suggestions for some of the difficulties in profitable orchard management.

Pruning practices to-day are radically different from those practised in the past, and the new recommendations are based on experimental results. The much discussed fertilizer problem is now being studied from a plant physiological and biochemical standpoint. Together with external observations this has enabled us to see this problem in an entirely new light, and although definite rules cannot and perhaps never will be made on account of differences of location, many helpful and suggestive recommendations have been the outcome.

Fruit bud formation is another phase of study recently investigated by several men among whom Roberts of Wisconsin is probably the most recent.

Between pruning, fertilization and fruit bud formation or fruitfulness is a close relationship, and to fully understand one, it is necessary to have a knowledge of the others.

The present article is intended to review and bring up to date our knowledge of pruning, and fertilization and its relation to fruitfulness or fruit bud formation.

Not many years ago, it was a common practice in the care of the young orchard to head or cut back annually, regardless of the condition of the tree. In fact, this principle in a more or less modified manner was extended to older trees in bearing.

Some few years ago we cautioned against indiscriminate heading back or butchering of trees, but advised that for the first few years of a tree's life, heading back was necessary, especially with varieties tending to produce long growths, with few laterals.

At the Vineland Experiment Station unpruned trees have yielded slightly better than trees pruned. But trees pruned lightly in late summer have yielded almost as well as the unpruned, and have the added advantage of being in better shape for future performance. In fact, the unpruned trees if left indefinitely will reach a condition where drastic treatment will be necessary to relieve the congestion and to renew the fruiting surface of the tree.

At Ottawa, on young trees we have found that no pruning has given as good total growth as either spring or summer heading back, accompanied by a larger girth measurement. Where severe heading back was practised, the girth measurement was much less than in the unpruned plots and the trees presented a less vigorous appearance.

Where light heading back practised for the first three years was adopted, the comparison between trees pruned and unpruned showed little difference in favour of the unpruned, but those trees which had been pruned were of decidedly better shape and in better condition for future work than the ones where pruning had been neglected.

These results have simply justified our general orchard practice of years past, viz., to prune during the first few years of a tree's life with the express purpose of obtaining a desirable amount of growth placed where we want it.

In the case of some trees this will require considerable cutting out and some cutting back for the first three or four years. In other cases, it will require very little wood removal, but in all cases the trees should be attended to annually.

Although in the light of modern research we would say, "prune only as much as is necessary to produce a tree of de-

sired type and form," we would caution against swinging from severe pruning to absolutely no pruning for a considerable period, the sequal of which would ultimately be a rather too severe heading back and cutting out to correct past neglect with a possible consequent upset in the balance between nitrogen and carbohydrates. In short, more or less severe heading back and thinning out during the first four years after planting may be necessary to mould the form of the tree and may be practised without economic loss of vigor. After that, however, severe annual pruning should be discontinued and trees which are bearing annually should receive light annual pruning, sufficient only to maintain symmetry, to prevent too long or rangy growth and to prevent the establishment of long limbs with growth only at the tips.

The principles which lie behind these pruning recommendations will be discussed later in this paper. In the meantime let us consider the status of orchard fertilization.

Unfortunately we are only beginning to see the light in this direction, but even now there is much food for thought, and a note of caution should be sounded here against the too liberal use of potash and phosphates throughout our orchards. In so far as the individual is concerned this problem will need to be investigated locally on orchards situated on as many different types of soils as are common in the orcharding sections.

In the meantime, however, science has given us some general principles which should materially assist many in reducing their fertilizer bills.

Kraus and Kraybill have shown us (1) that there must be a correct balance between nitrogen, carbohydrates and moisture before we can get fertilization and vegetation combined, (2) that an abundance of moisture and nitrogen without an available supply of carbohydrates results in weak and unfruitful plants, (3) that an abundant supply of nitrogen and available carbohydrates gives increased vegetation and non-fruitfulness, and (4) that lack of nitrates with available carbohydrates is similar in results to an abundant nitrogen supply and a low amount of carbohydrates, that is weakened and unfruitful plants results.

There must exist, therefore, an available supply of carbohydrates, available moisture and sufficient, but not an over abundant supply of nitrates if fruitfulness and vigor are to be obtained. In short it is not so much the absolute amount of each present that counts but their proportion to one another.

Unless artifically supplied to the soil, the plant is dependent for its nitrogen upon processes known as nitrification wherein unavailable supplies of nitrogen are changed into nitrates and thus made available for plant consumption. Nitrification requires a comparatively warm and well aerated soil. As trees start into growth early in spring before the soil temperature is relatively high, it is conceivable that nitrification processes are at that time not very rapid, and except on soils rich in nitrogen, the actual supply available for the plants at that time of year is probably insufficient for the plant's needs.

Carbohydrates are manufactured by the leaves and it should be here added that any quantity of carbohydrates in excess of what is required for the immediate consumption of the tree is stored in the form of starches in that portion of the tree close to the leaves which manufactured it.

This is the condition of healthy trees during winter, viz., stored reserve supply of carbohydrates within the plant tissues. Although there is some storage of nitrogen, practical experiments indicate that the tree in early spring calls upon the soil for a further supply of this element.

Soil nitrification being slow in the spring and slower still in a cold wet spring, early applications of nitrate of soda often result in increased productiveness. Without available nitrogen at this time of year the carbohydrates are in too large a proportion to the nitrates with resulting suppression of both vegetation and fruitfulness.

Although an early application of nitrogen will give desired results it is not to be presumed that applications made in midsummer or late spring will do likewise. At these seasons soil nitrification is at its height and further applications of nitra-

tes would probably result in increased vegetative growth of the tree, and if the supply of nitrates continued to be abundant or in excess as compared with the carbohydrate content of the tree, late vegetative growth with resultant winter injury may take place. It is not unusual to see trees injured by the application of nitrates, not that the nitrates have a toxic or deliterious effect upon the plant, but because of the presence of too much available nitrogen late in the season causing the tree to enter the winter with unripened wood, with subsequent winter injury showing up the following year.

Where nitrates have not been used and trees in spring present considerable yellow leaf and an unthrifty appearance, recovering later in the season, an application of five pounds per tree the first year is not out of place. But to continue this amount annually might result in over-stimulation so that the grower must, by intimate study of his tree, decide upon the frequency and quantity of these applications.

Later when discussing fruit bud formation it will be seen how these early applications of nitrogen may materially assist in maintaining annual bearing by establishing a correct balance between carbohydrates and nitrogen supply.

In orchards grown on sod where little nitrogen has been supplied we often find a condition where an application of nitrates will work wonders in productiveness. In such instances the trees already have an abundant supply of reserve carbohydrates, but lacking nitrogen are unable to fully utilize these reserves for vegetative extension and fruitfulness.

It might be well to point out here that this balance could at least be temporarily obtained by severe pruning for by such a practice the leaf area is reduced with a consequent reduction in available carbohydrates, thus relatively increasing the nitrogen carbohydrates ratio. Probably in the case of older trees which are barren a moderate heading back under such circumstances accompanied by a light application of nitrates would be a better means of establishing the proper balance.

All this tends to illustrate that nitrogen is not only essential for vegetative extension but for fruitfulness as well, that there is close relationship between vegetative extension and fruitfulness and that the two are not diametrically opposed as has too often been thought.

At this juncture reference should again be made to the abandoned practice of yearly heading back. What is the explanation of the poor vigor and delayed fruitfulness of trees grown under this system? Simply that in removing such large quantities of wood a considerable amount of carbohydrates as well as the future means for its manufacture were removed and a condition of relatively low carbohydrates content and abundant nitrogen supply resulted with necessarily reduced vegetative vigor and delayed fruitfulness.

We have seen then that there must exist a correct balance between the nitrates and carbohydrates; that this may be re-established by the addition of nitrate to the soil in early spring, and by early cultivation; or that by reducing the top of the tree, thus lowering relatively the carbohydrate nitrogen ratio, we can arrive at the same end at least temporarily. Thus is established the close relationship between fertilization and pruning.

Before leaving the question of fertilizers, reference must be made to potash and phosphorous.

Although nitrogen seems to be the one fertilizer which is giving the most universal results, it does not necessarily mean that we have in the past been wrong in assuming that potassium and phosphorous have a part in the chemistry of the plant.

Indeed potassium appears to be very essential to fruit production. Hooker in his chemical studies of the apple buds found that bearing spurs had a high potassium content in the spring whereas non-bearing and barren spurs exhibited no such condition. The inference is that potassium is quite as necessary as any element for plant life and reproduction.

Results from practical fertilizer tests give contradictory results with reference to potash.

Alderman in Virginia in working with peaches found that muriate of potash used alone checked growth when used at the rate of one pound per tree and exhibited a distinct toxic effect at two pounds, with

death at two and one-half pounds. When used in conjunction with nitrate the evil effects were ameliorated but more pronounced when used with slag. His results with sulphate of potash showed that larger amounts could be used without injury but in no case did benefits accrue.

Stewart in Pennsylvania records similar results on some soils and beneficial results on others.

This evidence is very conflicting when compared with our former conception of the necessity of yearly applications of potash on practically all orchards. Now do not gather from this that potash is not useful as a fertilizer, for it undoubtedly is. The point the writer wishes to impress is that until by experimentation it has been shown in your district that your soils are deficient in this element the use should be practised with caution. Potash is found in fairly large amounts in many soils and is a much more stable product than nitrogen which is usually lacking, especially in sandy or lighter soils. Hence it is quite probable that many of the orchards in the valleys have a sufficient supply of potash for some few years to meet the demands of the trees.

Phosphorous has a distinct position in ordinary farm crops and is likewise a necessity in the production of fruit. Although the average soil is probably more deficient in phosphate than in potash, nevertheless conflicting results from its use have been obtained, although not to such a marked degree as with potash. If the soil is deficient in this element it should certainly be made up, but beyond this it is impossible to make any recommendations, except to urge upon each orchardist for the time being the advisability of turning a small corner of his orchard into a fertilizer test plot.

In short you would do well to turn your attention to the value of nitrogen as an early spring application and to study the growth of your trees and attempt to establish that necessary balance between nitrates and carbohydrates, holding in reserve in the meantime your judgment on potash and phosphates unless you are fully convinced that your soil is impoverished in these elements.

The recent findings with regard to fruit bud formation have assisted materially in a better understanding of the fertilizer and pruning problem. A number of investigators have given this problem considerable attention, and the sum total of all their findings, although not complete, has presented this phase to us in a fairly comprehensive manner.

One outstanding truth is that fruit bud differentiation on spurs takes place fairly early in the season. Roberts says July 5 and previous to that date. Crow found last year that his experiments indicated no possibility of influencing fruit bud differentiation after the trees were in full bloom. Roberts is drawing his conclusions from the fact that July 5 was the date when microscopic slides first showed differentiation between vegetative and fruit spurs.

Crow removed all the blossoms from some branches producing heavy bloom and then observed spur growth, making his observations on the basis of the types of spurs defined by Roberts the previous year.

These types of spurs are:

(1) Short spurs averaging $\frac{1}{8}$ inch; these produce only leaf buds,

(2) Spurs averaging 3/16 inch. and which blossom but do not fruit.

(3) Spurs averaging $\frac{1}{2}$ inch which blossom and fruit.

(4) Long spurs averaging $\frac{3}{4}$ inch in length and over, which do not blossom or fruit.

On the branches which were allowed to bloom heavily all the spurs formed during 1920, that is the year of the heavy bloom, fell into the short fruit spur and long leaf spur classes. That is, these spurs would not fruit the following year.

Where the blossom clusters were removed two or three days before the first petals began to fall, he was able to throw a very large percentage of these short spur growths into the strong spur class and these would fruit the following year.

When blossom clusters were removed after the first petals began to fall no increase in the formation of strong fruit spurs over the check could be observed. From this it would seem that any treatment designed to increase fruit bud formation or differentiation should be made early in the season.

This is not contradictory to Roberts but

simply indicates that, although we may not be able to determine actual differentiation before July, to influence such determination treatment must be given much earlier in the season. Crow's trees blossomed about the 27th of May.

Biennial Bearing.

Roberts' work has been in connection with alternate bearing. We all know that many trees of many varieties and even many orchards have the bad habit of bearing heavily every other year. Formerly it was considered that bearing a heavy crop one year was the reason why a tree could not produce a crop the following season and consequently that thinning the fruit after it had formed on the tree would induce regular bearing by lightening the load for the tree that season. This practice has not resulted in regulating biennial bearing, although it is a very valuable feature of orchard management.

There is more evidence that fruit or blossom bud formation is due to nutritional conditions within the tree, which cannot be altered late in the season to give any immediate relief.

Roberts was able to prevent blossom bud formation by removiing the leaves from the spur and here is a lesson to those who take little care of the foliage of their trees. Not only do they lessen the crop of the current year but they ruin their chances of a crop the following season.

Other points brought out in these investigations of Roberts and others are worth considering.

Magness showed that not only do apples produce fruit on spurs, but also on axillary or side buds produced on wood of the previous season's growth and some on terminal growths which could hardly be classed as spurs being too long to fall in that category. At Ottawa we found that most varieties when young produced from fifty to seventy-five per cent of their fruit on axillary or terminal buds, whereas these same varieties when older produced a very small proportion of their fruit on these kinds of buds.

Young Dudley trees produced most of their fruit from terminals and axillaries, young Wealthys produced 60 per cent from these types of buds, and so on.

The point to be made here is that as these would largely be removed when a severe system of heading back is practised after a tree is three or four years of age, we have another reason added for not adopting too vigorous a system of annual heading back. Further that as old trees are not so dependent upon this type of fruiting wood, heading back without being carried to a point where it would upset the nutritional balance would not lessen materially the actual number of blossom buds by removal.

Some of the more salient features in Roberts' work, including those already mentioned, are: (1) that biennial bearing appears to be related to nutritional conditions and not to overbearing, and that thinning of the fruit does not give regular bearing, (2) that fruit spurs have a very short period of growth and that the blossom buds are formed nearly a year in advance of blossoming, (3) that spurs act largely as individuals, that is, irrespective to a large extent of the rest of the spurs on the tree, (4) that blossom bud formation depends upon nutrition; it is related to spur length, the longer spurs producing blossom buds and the length of the spur being determined by the nutritive elements avilable, (5) biennial bearing is related to spur growth, that is, when all the spurs on a tree are blossoming heavily, as has been pointed out earlier in this paper, no long spur growths for the next year's crop are produced, the spurs not functioning in a vegetative manner to any extent, (6) a full crop of fruit may be borne when 35 per cent of the spurs on the tree blossom; that is, it is not necessary for all the spurs to blossom to set a full crop of fruit, and here it should be pointed out that the percentage of blossoms setting fruit is in inverse ratio to the percentage of spurs blossoming. In other words, when 20 per cent of the spurs are vegetative or non-fruiting, only 36.4 per cent of the blossoming spurs set fruit, whereas when 41 to 60 per cent of the total spurs were vegetative, 81 per cent of the blossoming spurs set fruit.

Think of the needless waste of bloom on a tree that is overloaded with it, or one which has all its spurs blossoming. It now remains for us to see what suggestions may be offered to regulate biennial bearing and

to induce fruitfulness under different conditions.

Where the trees are, or should be, in full bearing, four conditions may exist: The tree may be non-blossoming, i.e., producing very short spur growth; it may be blossoming but non-fruiting, i.e., producing only weak blossoming spurs; it may be biennial bearing; or it may be annual bearing.

In the first two instances vegetative vigor is evidently at a low ebb and early applications of nitrates and early cultivation should induce longer spur growth with resultant fruitfulness. Or the same end could probably be reached by cutting back lightly in the vicinity of fruit spurs.

Where the tree is biennial bearing, treatment should commence in the off year. During this year if left to its own devices an over abundance of spurs will fall into the ½-inch and 3/16-inch class; these will be blossom buds which will blossom and fruit or blossom and not fruit. If a percentage of these can be induced to become over-vegetative it will reduce the proportion blooming the following year and those spurs which have become over-vegetative during the off year will form blossom buds during the following season and fruit the season after.

Here again the application of nitrates might have some effect if applied early enough, but probably a light pruning would be more advantageous. The pruning in this case should consist of light cuts made in the vicinity of the fruit spurs, and should be distributed over the entire tree as pruning is largely local in its effect. The removal of a few large limbs will not serve the purpose. It should be done before the buds break. The importance of the admission of sunlight to all parts of the tree should be pointed out. We have seen that carbohydrates are essential to fruitfulness as well as nitrogen; also that carbohydrates are stored very close to their point of manufacture; that the removal of leaves from spurs prevented blossom bud formation on that spur without inhibiting blossom bud formation on other spurs of the same tree not so treated; that consequently we are led to conclude that spurs, branches, or local parts of a tree act largely as individuals and it should be added that for carbohydrate formation sunlight is necessary.

Considering, therefore, the previous paragraph it will readily be seen that light must be admitted to all parts of the tree if the older spurs are to function properly, for these older spurs far down the tree cannot draw on the leaves at the top for their carbohydrate supply.

Another phase of horticultural research upon which we are slowly gaining knowledge is the question of pollination. To obtain fruit it is not only necessary for pollen to be produced, but it is necessary that the pollen be capable of germination and ultimately must reach the ovary of the plant in time to bring about germination. Dorsey in his researches on pollination of the plum has shown us that the rate of pollen tube growth is a factor of great importance. He has demonstrated that in so far as the plum is concerned the abscission of the style takes place fairly constantly and is not hastened or delayed to any great extend by the changes of weather. Further that wet weather may prevent the opening of the pollen sacs or in scientific parlance delay dehiscence, and that even under favourable conditions the rate of pollen tube growth in the plum is so close in length of time to that of the effective life of the style that a delay of a day or two may prevent the pollen tube from reaching the ovary before abscission of the style has taken place.

As pollen liberation may be delayed by weather and as subsequent growth of the pollen tube after dehiscence is regulated largely by weather conditions the factor of safety in blossom pollination is rather small.

There is a problem here which may have an ultimate bearing on our future pomology. Is there an appreciable difference in the rate of pollen tube growth of different varieties of the same species? If so, and we can select as pollinizers those which exhibit a very repid rate of pollen tube growth, we may go a long way toward solving some of our present difficulties of light sets where a full bloom is in evidence.

Not only is it possible that there is a variation in the rate of pollen tube growth but there may also be a difference in style length. This latter, if found of value, being

of course more of a factor to be considered in future breeding work than one to overcome present difficulties with existing varieties.

Closely allied to the above may be the affinity of one variety for another and pollen production.

In the foregoing pages the writer has endeavoured to place before the reader a few phases of science as applied to horticulture in a practical sense. Very simple and elementary it is true, and not at all a scientific treatise such as a scientist would give to his colleagues, but nevertheless a discussion on the practical application of a few scientific findings.

Horticulture is not only the mere growing of fruits, vegetables and flowers; it is a far broader thing. It is the co-ordination and practical application of the fundamental sciences of soil activities and plant growth, and the successful horticulturist of to-morrow must have not only a knowledge of his species and his varieties, but a clear and working conception of the sciences of soils, plant nutrition, pathological conditions, the laws of heredity and cytological phenomena, etc., as related to plant growth, and he must further be able to marshal the facts and principles of these sciences in such a manner that he obtains in their practical application the greatest possible commercial efficiency.

DOMINION APIARIST DROWNED.

On Saturday, September 10th, Mr. F. W. L. Sladen, Dominion Apiarist, was drowned in the waters off Duck Island in Lake Ontario. There was no person with Mr. Sladen at the time and it was therefore difficult to obtain any particulars in regard to the circumstances surrounding his death. As the deceased was unable to swim, it is presumed that while bathing he stepped from a ledge of rock into deep water and that death occurred either from drowning or from heart failure. The body was found some hours later and was brought to Kingston, whence it was removed to Ottawa for burial. The funeral service was held at the First Congregational Church, Ottawa, on Tuesday, June 13th, at 2.30 p.m.

Mr. Sladen was born and educated in England, where he early became known as a bee expert. Since coming to Canada in 1912 he has made a special study of bee breeding, honey-producing plants and the localities best suited for the bee industry. He aimed to improve the strain of bees and his work was regarded in scientific circles as of the highest importance. His death is undoubtedly a great loss to agricultural research in Canada. He joined the Canadian Society of Technical Agriculturists in April, 1920, during the organization period of that Society, and was always interested in its work.

The deceased was in his 45th year. He is survived by his father in England, his widow and three children—two sons and a daughter.

At the funeral service in Ottawa many officials of the Dominion Department of Agriculture were present, including Dr. J. H. Grisdale, Deputy Minister, E. S. Archibald, Director of Experimental Farms, F. C. Elford, Dr. M. O. Malte, H. T. Gussow, Dr. C. E. Saunders, Arthur Gibson and W. T. Macoun. The C. S. T. A. was represented by Fred. H. Grindley, General Secretary and O. C. White, Secretary of the Eastern Ontario Branch.

Results of Fruit Culture on the Forest Nursery Station at Indian Head

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(Paper read before the Official Horticulturists' Association of the Northern Great Plains.)

This station was not established with a view to doing any special work with fruit and we have no appropriation for developing that line. However, we received so many enquiries for information as to the varieties which may be grown under prairie conditions that the writer thought it advisable to make a trial of what might prove successful so as to have some practical experience on which to base such information.

Of course we all known that currants and raspberries may be grown to perfection. Gooseberries and strawberries have also proved very satisfactory. Beyond securing a few plants of unnamed sorts from the Experimental Farm we have done nothing particular with currants. With raspberries, however, we planted a number of kinds such as Louden, Turner, Minnetonka, Shipper's Pride, Sunbeam and Herbert, and later, in 1919, Chata, Minnesota No. 4 and St. Regis. Of course the Herbert has undoubtedly proved the strongest grower and most prolific, with immense berries. The Minnesota No. 4 appears very promising and may equal the Herbert when plants are well established. We do not find that the Herbert is any less hardy than other kinds. Our canes are always laid down for winter and grown under the hill system.

We made no trial with gooseberries until 1919, when plants of Pearl, Carrie, Rideau and Downing were set out. These have all made great growth and commenced to bear well this season.

With strawberries, we started in 1906 with Senator Dunlap and Bederwood. The former has given us good crops every season since. The Bederwood, while doing very well in certain seasons, has not been so uniformly good. We have been trying the everbearing varieties for a number of years such as Progressive, Superb, Americus and 1017. It cannot be said that with us these have given such good results as the Senator Dunlap. In favorable seasons with plenty of rain we have had good berries up to the middle of October; but for the home garden to grow for preserving purposes we would consider the Dunlap most suitable. A very large percent of the everbearers killed out with us last winter, while the Dunlaps under the same conditions came through well.

Of the plums we have tried Aitkin, Cheney, Stevenson's Mammoth and the native Manitoba wild plum. Of these the Mammoth has borne heavily and produces a fruit of good size and fair quality, especially for preserving. The Aitkin blossoms very early and sometimes gets caught by frost. Still our trees have for four or five seasons borne fair crops. The fruit is of good size and very attractive appearance but not of particularly good quality. The Cheney has given us very heavy crops, three to four weeks later than Aitkin, and makes most excellent preserves. We secured quite a large number of the Hansen Hybrids which have been planted now about six years and all have proved reasonably hardy. Of these the best and most prolific are Sapa, Oziya and Opata. The Sapa bears very heavily, the fruit is deep crimson and the flesh a deep red. It makes a splendid preserve of quite distinctive flavor. The Oziya is a good sized yellowish fruit of very pleasing flavor. Under Professor Hansen's advice these Hybrids have been grown in bush form so that the branches may be laid on the ground for winter protection. We also got from Professor Hansen the Tokata. This seems to be more of the plum type, both in habit of growth and size of fruit. These bore fruit first in 1920 and this season show a very good crop. The fruit is larger than the Mammoth, ripening pos-

sibly a few days later. The flavor, however, is more distinctive and it is by far the best variety for eating that has been grown here yet.

The Compass cherry has also borne well with us for several seasons.

It would appear from our experience that there is no difficulty whatever in growing these hardy plums under our prairie conditions. Certainly sufficient quantities of these fruits could be grown on almost any farm to supply the home requirements. No doubt for best results a good shelter belt to protect the trees from wind and storm is advisable, but it is not at all a difficult matter to establish a good shelter in a very few seasons.

The writer was very anxious to see what could be done with standard apples and was encouraged by what had been accomplished by Mr. A. P. Stevenson of Morden, Manitoba. Crabs of various kinds had proved fairly successful on the Experimental Farm at Indian Head, and in 1906 Mr. Angus McKay furnished a few seedlings of Dr. Saunders' Hybrids which had been sent out from Ottawa. After five or six seasons these commenced to show fruit but most of them were very small and disappointing. One or two of the seedlings had fruit about one inch to an inch and a quarter in diameter, but these killed out after a few more seasons. One of these seedlings appeared very hardy but the fruit was extremely small and of no value. However, scions of Wealthy and Charlamoff were obtained from Mr. Stevenson and top worked on to this seedling. The grafts took well, but subsequently many of the Wealthy killed back. This tree now stands about fourteen feet high and this season is bearing a very fair crop of both Charlamoff and Wealthy. One graft of Wealthy is bearing very heavily and the fruit is of very good size.

At the time the grafts were obtained, Mr. Stevenson also furnished young trees of Blushed Calville, Hibernal, Antonofka, Simbrisk, Kluvescoe, Gypsy Girl, Patton's Greening, Duchess and Charlamoff. These mostly grew well but showed considerable winter killing for several seasons, and after four or five years it did not look as though we could get any results; then the trees seemed to pick up and were getting into good shape when, during the winter, rabbits cleaned out nearly every tree. It seemed to be impossible to do anything against the rabbits and only those portions of the lower limbs which were wrapped with burlap escaped barking. In the spring the trees were a sorry looking lot and prospects appeared hopeless. However, they were cut back, the wounds painted, and to avoid similar damage in future a six foot rabbit fence was erected all around the small orchard. The trees were badly weakened and an occasional one succumbed. However, new growth was made and the trees gradually recovered, though owing to the wounds received most of the trees appeared to get badly affected with some fungus. This season for the first time the growth looked healthy and vigorous and nearly all varieties showed more or less bloom. A few of the trees are bearing a fair crop of very excellent apples. Particularly the Hibernal and Blushed Calville are bearing well. The Charlamoff, except those top worked, have not shown any fruit. We also have a few apples on the Gypsy Girl, Patten's Greening, Antonofka, Simbrisk and Whitney Hybrid and now feel more encouraged as to the future.

A number of years ago the writer secured a quantity of seed of Wealthy apple from Mr. Stevenson and set out 1,500 or 2,000 seedlings from this seed. The majority of these winterkilled so badly that most of them were cut out about five years after, leaving probably 30 or 40 of the hardiest. These have not yet all fruited but those that have are more or less of the crab type, though some are very prolific, with fruit from an inch to an inch and three-quarters in diameter. One seedling tree fruiting this season for the first time is more promising, with a fruit of nearly two inches in diameter.

On the whole we are encouraged to believe that it is only a question of time until suitable kinds of standard apples can be developed which will prove successful under our conditions. While the Russian varieties above mentioned give promise of some success, it is probable that seedlings of these, or seedlings of specially hybridized varieties are what we must eventually look to for more certain results.

A New Seed Cleaning Process

By EDGAR D. EDDY
President, Eddy Seed Cleaners, Limited,
Toronto, Canada.

Accurate separation of seeds on the basis of comparative specific gravity has long been recognized as highly desirable and many attempts by various means have been made to effect it. The separations by air currents as employed in standard seed cleaning machinery are far from accurate, as anyone realizes who has tried to make a complete separation by ordinary mills, of seeds which are nearly the same specific gravity. Some success has been achieved with small lots of beans, peas and cereals by introducing the grains into a brine, stirring the whole mass and allowing the heavier kernels to sink and the lighter ones to float. For various reasons this method has been found impracticable and has been employed only in a limited way for preparing special samples for experimental or other purposes.

Experiments With Liquid.

While attempting to determine the comparative specific gravity of clover seed and certain weed seeds, the writer observed that when a mixture of seeds was introduced into and agitated with a liquid of specific gravity intermediate between that of the light and heavy seeds, the desired separation was not effected because of air envelopes adhering to the heavy seeds causing them to float, and surface tension causing light and heavy seeds to cling together in clusters, many of which would remain suspended in the liquid instead of sinking or floating. To overcome this condition, a test tube containing a seed mixture in liquid was subjected to pressure in a milk-testing centrifuge, thus expelling all the air from the liquid and from around the seeds. A perfect separation then resulted, as each individual seed was free to sink or float according to its specific gravity in comparison with that of the liquid. Further experiments with a re-built small cream separator bowl clearly demonstrated the practicability of separating seeds by centrifugal action in a liquid of proper density, and the value of the separations effected. The problem then was how to provide for continuous separation and at the same time maintain continuous discharge of both the heavy and light portions of the seed mixture. This has been accomplished by a method entirely new in centrifugal separator construction. The machine operates continuously and at large capacity.

Centrifugal Action and Liquid.

As now developed and applied on a commercial scale, the process does for seed cleaning what the cream separator did for the dairy industry. It utilizes centrifugal force to separate completely and instantaneously particles of different specific gravity. As the separation of butter fat from the other constituents of milk by gravity is slow and incomplete, so the separation of seeds which are slightly different in specific gravity is very imperfectly done by gravity and air currents. And, as centrifugal action makes a perfect and immediate separation of butter fat from the other constituents of milk, so it makes a perfect and immediate separation of seeds or other solid particles of only very slightly different specific gravity when the necessary medium is provided.

In order that centrifugal action may be effective with seeds or other solid particles it is necessary that a liquid carrier be provided, the specific gravity of which should be at a point intermediate between the specific gravities of the materials which it is desired to separate. When the seeds and liquid are introduced together into a rapidly revolving bowl the seeds which are lighter than the liquid are forced to the centre, while those which are as heavy as or heavier than the liquid are thrown to the circumference. By regulating the density of the liquid, the proportions of the seeds going into the light and heavy separations are under perfect control. The liquid used for cleaning clover seed usually requires a density of about 1.2.

Drying.

As the cleaned seed is delivered with the liquid, a rapid and harmless drying process is necessary. For this purpose centrifugal action is again employed. The liquid is thrown out of the seed very thoroughly by a high speed extractor and re-used for separating purposes. While still revolving in the extractor the seed is sprayed with clear water to remove all traces of the liquid. When the seed is sufficiently washed the water is turned off and forced out by centrifugal action. This leaves the seed free from all loose moisture and in condition to dry very quickly in an air dryer which requires comparatively little heat. By these means the drying is effected very quickly and with no possibility of damage to color or vitality. The seed is immersed in the liquid during the separation process not more than thirty seconds. Within about three minutes from the time the seed is first wet all the loose moisture is thrown out by the extractor and within from thirty to forty-five minutes it is thoroughly dry.

Separations With Clover Seed.

The results from cleaning seeds commercially and from experimental work with small samples prove that by this process many very valuable separations can be made completely and with practically no loss of clover seed, which with the best available screen and air current mills can be made only very imperfectly, if at all, and with a heavy loss of good seed.

It has been found that with most of the botanical families the specific gravity of the seeds is a fairly constant character and that approximately similar results are secured with seed of different species within the same family. The specific gravity of the seeds of several of the plant families is less than that of clover seeds and a perfect separation is effected by this process. Among these are the following, containing important weeds: Sunflower family (*Compositae*) including Ragweed, Mayweed, Ox-eye Daisy, Canada Thistle, other thistles and Chicory; Mustard family (*Cruciferae*) including Wild Mustard or Charlock and other mustard species, Stinkweed or Pennycress, False Flax, Peppergrass and Shepherd's Purse; Parsley family (*Umbelliferae*) including Wild Carrot; Borage family (*Boraginaceae*) including Blue Bur or Stickseed and Blue Weed.

With the Grass family (*Gramineae*) the seeds are perfectly separated from clover seed if the hulls or glumes are attached. When the kernel or caryopsis is hulled the specific gravity is about the same as that of clover seed and the separation is imperfect. Unhulled timothy and other cultivated grass seeds are separated completely from clover seed. Green Foxtail is very greatly reduced but not always entirely eliminated.

With the Buckwheat family (*Polygonaceae*) the separations possible are dependent upon the condition of the seeds. The specific gravity of the true seed is about the same as that of clover seed but most of the species normally have an outer seed coat of lighter material which makes separation possible. This is usually true of Sheep Sorrel and to a lesser extent of Docks.

The Plantain family (*Plantaginaceae*) seeds are mostly of a slightly less specific gravity than clover seed but the difference is not sufficient to make a perfect separation. Buckhorn or Ribgrass is usually reduced about 75 per cent while with Common Plaintain and other species the separation is somewhat better.

The seeds of the Pink family (*Caryophyllaceae*), including Cockles, Night--flowering Catchfly and Bladder Campion are of nearly the same specific gravity as clover seed and these separations are not complete.

With the pea family (*Leguminosae*) the specific gravity of the various species is practically the same and it is impossible to make a separation of Black Medick or Trefoil or other wild clover seeds from those of cultivated sorts.

Small Loss in Cleaning.

A very great advantage of the process is that the loss in cleaning is very small. In attempting to remove weed seeds which are nearly the same specific gravity as clover seeds by the ordinary mills a heavy

loss of good seed is involved. With this process the division on specific gravity basis is accurate and the loss of good seed is reduced to the minimum. Some of the lots of alsike seed were cleaned from Rejected to No. 1 with less than 4 per cent loss. The loss is usually well under 10 per cent unless the seed contains an exceptionally large proportion of other kinds of cultivated seed, dirt, chaff, etc.. as well as weed seeds.

Color and Vitality.

Clover seed treated is greatly improved in color and general appearance by eliminating timothy seed, brown dead clover seed and small particles of dust and dirt adhering to the seed.

Germination tests have been made of several lots before and after cleaning and the results show somewhat higher germination with the cleaned seed. This is probably due in part to a certain percentage of the dead seed being removed, and in part to some of the seeds which were previously impermeable to moisture being made germinable by the process.

The color of samples of clover and timothy seeds which were treated a year or more ago is maintained as well as or better than that of the untreated seed.

More Seed Can Be Grown Profitably.

From the results noted above it will be evident that a large proportion of the clover seed produced and marketed can be made much cleaner and its commercial value greatly increased by the new cleaning process. A large quantity of low grade seed which with previous methods of cleaning, could not be made saleable, can now be put into good marketable condition. Several of the lots treated were practically unmarketable as received after being cleaned by ordinary methods, and were converted into good marketable seed by our process. A number of lots of screenings containing from 25 per cent to 50 per cent weed seeds were handled. From this material which was practically worthless the good seed was reclaimed and put into marketable condition.

The process makes it possible to utilize to good advantage a much larger proportion of the seed crop produced, and also to grow clover seed profitably on land infested with certain weeds, the seeds of which previously could not be removed from clover seeds. This applies to parts of Ontario where Ragweed, False Flax, Canada Thistle or Mustard have rendered clover seed growing unprofitable and to Western Canada where Russian Thistle, Stinkweed and Mustard have defeated several attempts to grow alfalfa and clover seed.

Timothy.

Timothy seed has been very successfully treated with the object of making a separation of the hulled and unhulled seeds. The original stock graded No. 2 on account of hulled seed and the separations graded Extra No. 1 (unhulled) and No. 3 (hulled). Alsike and other clover seed was completely removed from the unhulled portion of the timothy. Results with small samples indicate that the process will be valuable in removing certain weed seeds from timothy.

Seed Grain

The work with grain thus far has been limited to a few small lots but results indicate the probability of valuable separations being made, such as oats and barley from wheat, barley from oats, peas containing weevils from sound peas, and certain weed seeds from grain. By regulating the density of the liquid used any desired proportion of a sample of grain can be removed which makes possible accurate selection of seed on specific gravity basis. This may be of value in plant breeding work for developing heavy-weighing strains of grain.

CHANTECLER FOWL.

Breed Recognized by American Poultry Association.

The Chantecler, the only purely Canadian breed of fowl, originated by Brother Wilfrid at the Oka Agricultural College, is now a standard variety. The secretary of the Chantecler Breeders' Association in Ottawa received word from Seattle, where the annual meeting of the American Poultry Association was recently in session, that the breed had been admitted to the American standard of perfection.

Diseases of the Potato

By B. T. DICKSON,
Professor of Botany, Macdonald College.

Introduction.

The potato crop is of prime importance to Canada and therefore the importance of a knowledge of the diseases of the potato need not be stressed here — it should be taken for granted. Without quoting statistics, the losses from potato diseases amount to millions of dollars every year. This means that every year a percentage of the seed planted is useless, that a part of every acreage is wasted, that labor is not used to full advantage and, finally, that the grower suffers a direct financial loss whether he is growing potatoes for sale or use.

In dealing with this series the diseases will be considered in the order now given.

1.—Diseases in which insects are the agents of infection or in which insects are the direct cause.

These are:—

(a) Hopperburn (or tip burn).
(b) Mosaic and mosaic dwarf.
(c) Leaf roll.

2.—Disease caused by a myxomycete:—
(a) Powdery scab (*Spongospora Subterranea.*)

3.—Disease caused by bacteria:—
(a) Black leg (*Bacillus atrosepticus.*)

4.—Diseases caused by Phycomycetes:—
(a) Black wart or potato canker (*Chrysophlictis endobiotica.*)
(b) Leak (*Pythium de Baryanum*).
(c) Late blight (*Phytophthora infestans*).

5.—Disease caused by an Ascomycete:—
(a) Wilt and stem-rot (*Sclerotinia libertiana.*)

6.—Disease caused by a Basidiomycete:
(a) Dry stem-rot and black scurf (*Corticium vagum var. Solani.*)

7.—Diseases caused by Fungi imperfecti:
(a) Early blight (*Alternaria solani*):
(b) Wilt (*Fusarium oxysporum*).
(c) Common scab (*Actinomyces scabies.*)
(d) Skin spot (*Oospora pustulans*).
(e) Silver scurf (*Spongylocladium atrovirens.*)
(f) Dry rot of tubers (*Fusarium spp*).
(g) Net necrosis (*Fusarium spp.*)

8.—Diseases caused by conditions which adversely modify the normal physiological processes:—

(a) Black heart.
(b) Frost necrosis.
(c) Net necrosis.
(d) Spindling sprout.
(e) Hollow heart.
(f) Arsenical injury.

It will thus be seen that there are some twenty or more common potato diseases with which the grower may have to contend at different seasons.

GROUP 1.

In this group are placed three (or four) diseases in which insects play an important role.

(a) *Hopperburn*, or tipburn as it used to be called, occurs periodically whenever dry conditions prevail in potato growing areas. It was noted first in Iowa in 1876 by Osborn, but wilting of early varieties was the most pronounced characteristic. Osborn recorded the presence on such diseased plants of *Empoasca Mali* (Le Baron) known as the leafhopper. In 1908 its work was observed in New York, and again in 1909. Fraser reported it from Quebec in 1913, it was again serious in Iowa in 1915, and in Vermont in 1917. Ball in Wisconsin in 1918 studied the disease which that year extended from Montana and Kansas to New York and New Jersey. This year the leafhopper has been very prevalent in Quebec and hopperburn is certain to cause considerable loss.

Symptoms of the Disease.

The first signs of the hopperburn usually appear during the latter part of July or early in August with most severe effects from the middle of August to the middle of September. On some of the lower leaves a slight yellowing begins at the tip or edge

of terminal leaflets. As the injury progresses the yellow areas become brown, curl up and dry out. Thus the leaflet finally possesses a dark-brown, dried, uprolled margin with a band of green in the middle bordering the midrib (see plate). The remaining leaflets gradually become affected so that the whole leaf is involved (plate). When the season is hot and dry such leaves shrivel completely, the petiole gradually dries towards the stem and hangs limp so that a touch will cause it to drop. Whole fields may succumb to this injury in a period of two dry, hot, weeks so that a ''burned over'' appearance is given to the crop. Usually, however, the upper, young parts of the plants escape burning for a time owing to the fact that the adult females prefer young growing tissues for oviposition. It is not until the eggs hatch and the nymphs begin to feed that injury is noticeable in these parts. The nymphs, because they do not migrate rapidly, are restricted in their feeding to the area in which they were hatched, consequently causing severe injury in that area. Adults, on the other hand, fly at the slightest disturbance and thus their effect is more distributed.

During cool moist weather the burning is checked and this also applies to plants which have been sprayed with Bordeaux.

Effect on Plant.

The eggs are laid on the midrib and petiole of the potato leaf and when hatched the nymphs feed mostly by sucking juice from the larger veins in the upper part of each leaflet. This reduces the supply of sap for the smaller veins at the margin and tip of the leaflets and accounts for the fact that browning, rolling and drying out occur at the tip and margin. There is thus a direct loss of sap from the leaves followed by the death of large areas of leaf tissue. This occurs at the time when maximum growth rate of tubers should occur. Consequently, the tubers suffer and the greater the area of foliage affected the more severe the effect on the tubers. In cases where defoliation is complete, or nearly so, the crop is a total loss.

PLATE I.
A.—Normal potato leaf.
B.—Leaf affected with hopperburn.
(After N. Y. (Geneva).) Technical Bulletin 77.

Other Hosts.

Field observations show that this insect may live temporarily on many hosts among which are: bean, apple, beet, rhubarb, raspberry, red clover, Swiss chard, strawberry, cucumber, lettuce, dahlia, hollyhock, elm, box-elder, burdock, rose, etc.

On some of the above the leaf-hopper merely feeds, but on beet, apple, beans and box-elder it will also reproduce.

Life History.

The potato leafhopper (*E. Mali*) lives over winter in the adult stage in protected places such as among thickly growing weeds, in brush, etc. In June they come out from their resting place and feed for ten days or so on the apple and other trees and shrubs, and at this time females predominate. At the end of the feeding period they migrate to potatoes and beans and begin mating and egg laying.

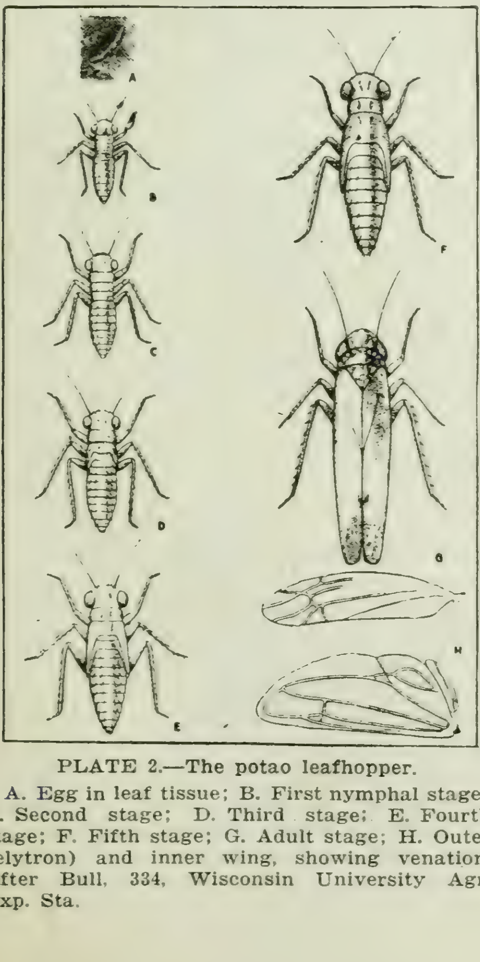

PLATE 2.—The potao leafhopper.

A. Egg in leaf tissue; B. First nymphal stage; C. Second stage; D. Third stage; E. Fourth stage; F. Fifth stage; G. Adult stage; H. Outer (elytron) and inner wing, showing venation. After Bull. 334, Wisconsin University Agr. Exp. Sta.

The eggs are about 1/30 of an inch long and are transparent at first. They are deposited in the petiole and midribs of leaves where they change from transparent white to yellow. In from ten days to two weeks the eggs hatch and the young nymphs appear as whitish, wingless hoppers. They begin to feed at once and as they absorb the plant juice they grow and become green. They shed the skin five times during their growing season and become winged adults in about seventeen days. When quite young they are to be found mostly on the lower side of the leaves and they move about but little.

The adult females have a long egg laying period and nymphs in all stages may be found up to the time of the first frost.

The first generation of the season causes the first noticed hopperburn on the potatoes. Adult females of this generation give rise to a second generation during the season and usually the severest attack of hopperburn occurs at the period when adults of the first generation and nymphs of the second generation are feeding at the same time. The over-wintering leaf hoppers are members of the second generation.

Varietal Susceptibility.

In Quebec the Irish Cobbler appears to be more susceptible to leafhopper-burn than Green Mountain. Unfortunately the writer does not happen to have at the present moment facts relative to susceptibility for other potato growing areas of Canada. In Wisconsin Early Triumph is affected worst and Rural New Yorker least. An important point to notice is that early planted potatoes are liable to suffer more from hopperburn than late planted varieties. It is also significant that plants from seed of diseased vines always suffer more severely than plants from seed of healthy vines.

Control.

Spraying with Bordeaux 4-4-50 is effective in controlling hopperburn provided that the underside of the leaves is sprayed thoroughly. This is obvious when considering the fact that nymphs feed on the underside of leaves as above noted.

Stem-Rot of Sunflowers in Manitoba

By G. R. BISBY,
Professor of Botany, Manitoba Agricultural College.

The cultivated sunflower (*Helianthus annuus*) is coming to hold a very important place as a silage crop in Western Canada and in other regions where corn does not thrive. Rust sometimes defoliates sunflowers to some extent, and other leaf diseases may cause slight reduction in the forage value of the crop; but in general, the plant is considered fairly free from disease. During 1920 and 1921, however, the disease mentioned below assumed considerable importance in Manitoba.

This disease may be called "stem-rot" or "wilt", as either name expresses a conspicuous symptom. "Crown-rot" would be very appropriate for the most common early appearance of the disease; but often, much more than the crown is affected and sometimes the crown itself may be normal while some upper portion of the plant is attacked. Since the name "wilt" as applied to plant diseases so commonly implies a clogging of the vascular tissue without external rot, it would seem that "stem-rot" is as applicable as any common name for this disease.

Figure 1.—Shows wilting of the plants in the field. August 10th, 1921.

The same or a similar disease of cultivated sunflowers was reported in 1912 by Lawrence (6) from the state of Washington, and attributed by him to a new species of Sclerotinia, *S. perplexa.* The disease apparently received little attention subsequently until 1920, when it was reported as common in Montana (7), Manitoba (1), Ontario (4), Oregon and Washington (8). It was also found in Minnesota for the first time (8). Morris and Swingle (7) consider the fungus to correspond closely to *Sclerotinia libertiana* Fcl., which is known to attack a large number of hosts, particularly vegetables. Brodrick found *S. libertiana* in 1919 on parsnips in Manitoba (2), specimens being sent to Dr. G. H. Coons who made the determination. It has also been reported on carrots (3, 9). The writer found Sclerotinia on both parsnips (see fig. 2) and carrots at Winnipeg in the fall of 1920, resembling the fungus found on sunflower, and inoculations showed that the fungus isolated from sunflower would attack carrots and parsnips. Jagger (5) has recently described a new species of Sclerotinia which is characterized by smaller sclerotia than are produced by *S. libertiana.* The writer has not definitely determined the species of Sclerotinia causing the sunflower disease in Manitoba, but can at least agree with Morris and Swingle as to its resemblance to *S. libertiana.* Conidia such as Lawrence described were not found in cultures of the fungus, although microconidia are to be found.

The disease has been found in Manitoba

at the Agricultural College, at Charleswood, at Clandeboye, at Brandon by Mr. I. L. Conners and at Morden by Miss Margaret Newton. No extensive survey of the province for this disease has been made.

A good opportunity was provided during 1920 and 1921 to study this disease in a field of about 20 acres at the Agricultural College, since the same field was planted to sunflowers both years. This field was near the Red River and had been principally covered with brush. The field was broken and sown to oats in 1919, then to sunflowers in 1920 and 1921. These were the first cultivated crops, except in one small area in the field (where the disease was worst) on which a farmhouse had once stood. The soil in this area contained much humus.

The stem rot was first found in 1920 on August 1st, It was found to be present in 1921 on July 17th. The plants found injured had all developed to 4 or 6 or more feet in height. Temperature or other factors seem to preclude attack upon seedlings or very young plants. The disease usually attacks the plants at or near the surface of the ground, and passes up and down, sometimes reaching two or more feet above ground under our conditions. Occasionally, cases are found where the organism has attacked the plant one, two, or more feet above ground, the stem being healthy below. The affected area is at first slightly sunken and black, but the colour fades to a brown and finally to a yellow. Mycelium of the fungus is usually abundant, outside and within the stem; although under dry conditions, it may not be evident on the exterior above the ground. This mycelium becomes aggregated into sclerotia which are white at first, then black outside and white within. The mycelium spreads abundantly through or on the surface of the soil, and may be seen conspicuously present under leaves, or where moist conditions prevail. The plants wilt soon after attack by the fungus (Fig. 1) and the stems are easily broken at the injured area; as the disease progresses, the stem becomes shredded from the "retting" of the tissue, leaving strands of fibro-vascular bundles. Eventually the sunflower plant is killed, and dries out, thus checking the growth of the fungus, and hard sclerotia of various shapes and sizes are found abundantly within the stem, especially in the area previously occupied by the pith, and clasping the stem on the outside.

The disease occurred especially in patches in the field, as noted above, in which often practically every plant in a square rod or more was killed. Here and there, through the sunflower field, however, one or a few plants in a place would be found affected. The composite weeds, *Iva xanthifolia* and Canada Thistle (*Cirsium arvense*) were found killed in the sunflower field, but these weeds were less susceptible than sunflowers. Sclerotia were present within the stems, and isolations yielded the same fungus as was obtained from sunflowers. Mr. I. L. Conners also found the disease some distance away along the bank of the Red River on wild sunflower, *Helianthus tuberosus* and on Sow Thistle (*Sonchus arvense*). Infection of the soil in the field planted to sunflowers probably came about either from having been present on some vegetable once grown in a garden patch in one part of the field or from a natural infection of the soil by the fungus having grown on some wild host such as the wild sunflower. It may be noted that in most cases where the disease has been found in Manitoba, the sunflowers were grown beside or planted after vegetables. The same areas affected in

Figure 2.—The development of mycelium and sclerotia of the fungus on parsnips.

1920 showed the disease on the succeeding crop of sunflowers in 1921, and it was encouraging to note that the disease was not conspicuously worse in 1921 than in 1920, despite the opportunities for spread of the fungus in the field, the presence of infected débris in the field, and a damper season in 1921. The losses were, however, considerable in extent, and the disease is sufficiently threatening to the sunflower crop to deserve careful attention.

The Sclerotinia lives over winter in the soil, as is indicated by the fact that the same areas were affected in 1920 and 1921. Affected sunflower plants rarely produce seed, and no evidence was obtained that

Figure 3.—Leisons caused by the parasite, and externally produced sclerotia on sunflowers found affected in the field, August 19th, 1921.

the seed carries the organism. Tissue cultures were made in 1920 from the stem 48, 36, 24, 8, 6 and 3 inches above affected areas on stems and from opposite the tip of a lesion which extended further up one side of the stem than the other. In none of these cases was Sclerotinia mycelium obtained. The organism may, however, be obtained readily from tissue cultures from affected areas. It is evidently not systemic in affected plants.

Inoculations were made during the winter of 1920-'21 upon sunflower and other plants in the greenhouse, and upon various vegetables. Cultivated sunflower plants about one foot high were killed by inoculation of the base of the plants with mycelium from a pure culture of the fungus and Sclerotia developed within the stem. The lack of light allowed only a slight growth of the plants. In the laboratory inoculations, a culture of the fungus into carrots and parsnips readily produced rot, and a considerable rot was produced upon potato tubers. Onions rotted only slightly. Turnips and beets did not rot in the preliminary tests made. Corn plants were not affected when the fungus was inoculated into the base of the plants in the greenhouse.

Tests were made during the summer of 1921 relative to the rate and manner of spread of the disease in the field. An isolated plot of sunflowers was planted, and on July 26th, 1921, inoculations were made by placing mycelium from an affected plant against needle punctures at the base of two plants; then the diseased stalk was placed between two uninjured plants and merely pressed into the surface of the soil. In one week's time, both punctured plants showed the disease conspicuously, and the plants on either side of the diseased stem, also were blackened at the base by the attack of the fungus. The spread continued to adjacent plants; on Aug. 18th, 5 plants along the row in one case and 11 plants in the other case in which punctures were made, were diseased. The fungus had spread along the row and caused rot for a distance of 2½ feet in 22 days in the case in which 11 plants were affected. No plants in the plot, other than these mentioned, became affected. No injuries except those that may naturally occur are necessary for infection.

Tests were not made with varieties of sunflower to determine whether resistance to the disease is to be found. The fact that so many hosts, including wild sunflowers and other weeds, may be attacked, makes the prospect for resistance, especially where the soil is heavily infested with the fungus, not very bright. Healthy plants are sometimes found in areas in the field in which practically every plant is

diseased; but these have no doubt merely escaped the disease; no definite evidence of resistance of individual plants was found.

Grains or grasses are not known to be attacked by this Sclerotinia. A crop rotation in which sunflowers follow grain crops would seem to offer hope of lessening the danger of the development of this disease, although tests will have to be made as to the length of time the fungus may remain active in the soil under various conditions. It is evident that the sunflower field should not be on or too close to the plot of ground used for garden on account of the danger of infection from the fungus being present on vegetables.

Summary.

A stem-rot of the cultivated sunflower, caused by a species of Sclerotinia, appeared during 1920 and 1921 in Manitoba. The disease is characterized by a rotting of the stem, usually at the surface of the ground, and by wilting of the plants. Certain weeds may also be affected as well as carrots, parsnips, and other plants. The fungus lives over winter in the soil. It attacks sunflowers when they have attained considerable growth. The fungus spreads rapidly in the field. It was not found to be systemic in affected plants. Sunflowers should not be replanted on fields which harbor the organism.

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EDITORIAL NOTE.

Dr. G. R. Bisby, the author of the foregoing article, has accepted a year's leave of absence in order to accept a position with the Imperial Bureau of Plant Pathology recently established at the Kew Gardens, London. There are over 50 appointments of plant pathologists in the overseas Dominions, Colonies and Protectorates of the British Empire, and this Central Bureau of Plant Pathology, in London, will serve as a central clearing house and co-ordinating agency for these scattered specialists.

CONSPICUOUS VALUE OF PURE BRED STOCK.

The value of purebred live stock, say specialists in the United States Department of Agriculture, is most noticeable in those cases in which the capability of the animals is measured most directly. Among farm animals the best illustration can be found in dairy cattle, though careful yearly tests of milk and butterfat production are relatively recent affairs. The enormous differences among dairy cows when given the same opportunity have been brought out clearly in a great number of cases, and these differences are strongly inherited through both the sire and the dam. The average production for purebreds and grades is much above the average of all milk cows, which is about 4,000 pounds of milk and 160 pounds of butterfat annually.—*Weekly News Letter, U. S. Department of Agriculture.*

Greenhouse Cucumber Breeding

By W. J. STRONG
Horticultural Experiment Station,
Vineland, Ontario.

(Paper read at Convention of Northern Great Plains Horticultural Association, recently held at Ottawa).

Compared with other horticultural crops the greenhouse cucumber occupies a rather minor position. It is not a cheap crop to produce, neither is it one that enjoys an unlimited market, and it can hardly be considered a staple crop such as cabbage, carrots, beans or onions. It ranks more as a luxury and is quite an aristocrat compared with its humble outdoor brothers.

As an article of food the cucumber, whether grown outdoors or under glass, is not looked upon with much favour by dietitians. Its actual value in calories is certainly not very great and most people consider that it is very indigestible. While cucumbers may not be of great food value yet they are appreciated by thousands of people as a relish.

The long green English type is not much in favour on our markets except in a few cases and on private estates. The market wants a cucumber that runs about eight inches long and two inches in diameter, so that 1½ dozen will pack into an eleven quart basket; but it is not altogether a matter of packing. Dealers and retailers find that the average families do not care to buy two feet of cucumber at a time. They much prefer to buy smaller fruits and buy them oftener.

So much for the size of cucumber required, which is comparatively easy to get.

What is our ideal cucumber?

Briefly, it should be about 8 inches long, 2 inches in diameter, straight, of even size from end to end, with no neck and without a heavy shoulder or small tip. It should be dark green, smooth, with white spines or spineless, and last but not least should set fruit freely without pollenation.

This free setting without pollenation is very important as it makes it unnecessary to resort to artificial pollenation either by hand or by bees. Artificial pollenation is laborious and expensive and bees do not work to advantage in the humid atmosphere of the cucumber house.

No pollenation of course means no seeds, and fruits without seeds keep in better condition on the vines than where seeds are formed. But seedlessness may have its disadvantages. We all appreciate seedless oranges and seedless raisins and most of us no doubt prefer seedless cucumbers, but the writer knows of one instance where a customer returned some seedless cucumbers with the complaint that they were not ripe.

Now it may seem that undue emphasis is being placed on the mere selling qualities of this crop, but that is really what we must keep in mind. We must produce something that the consumer wants or can be taught to want. The ordinary grower is not much interested in the principles of plant breeding. It is up to practical plant breeders to understand and be able to apply these principles and produce new fruits, vegetables and flowers, that will be of greater value or beauty than anything we have at present.

The need of the smooth, small, seedless cucumber must have been felt for a number of years as the original cross which has given us our new variety was made in 1910 by Mr. A. H. Maclennan, at that time lecturer at the Ontario Agricultural College and now Vegetable Specialist for Ontario.

In making this cross three varieties were used: first, Suttons Everyday was crossed with Fisks White Spine, then this hybrid was crossed with Princess.

A brief description of each of these varieties will not be out of place.

Suttons Everyday is of the long green English type with a bottle neck. It sets fruit freely without pollenation and is consequently seedless. It has a smooth skin

of dark green colour, with very few black spines and bears its fruits mostly in pairs at each joint. It also has a nice delicate flavour.

Fisks White Spine is the ordinary American White Spine type. It runs 6 to 8 inches long, is somewhat rough and does not set fruit without pollenation.

Princess is rather an odd-looking variety. It has rather dumpy fruit with rounded ends, has numerous black spines and bears its fruits in clusters of four or five at a joint.

These three varieties together have all the qualities we need in a cucumber. There is the free setting of the English variety together with its smoothness, colour and flavour. There is the smaller size and white spines of the White Spine variety and the rounded ends of the Princess.

Each of these varieties has also its undesirable characters such as the length and bottle neck of the English variety, the roughness and inability to set fruit without pollenation which characterize the White Spine type and the dumpiness and coarse black spines of Princess, together with roughness and lack of free setting.

Before proceeding further it should be pointed out that there are a few varieties of the White Spine type such as Davis Perfect, that do set fruits without pollenation, but they are usually quite rough.

With all these characters combined in the final hybrid it meant a great deal of careful selection work to eliminate the undesirable qualities and to preserve those that were worth while.

We have not been able to study the plants extensively enough to decide anything as to correlation of characters. However, we find that black spine is dominant over white and spinelessness and that freer setting appears to go with the dominant black, but we found a free setting white spine recessive and this breeds true.

By careful selection of the most desirable type of plant and fruit for the last five generations we seem to have arrived at the point where we can say that we have a distinct new variety which approximates pretty closely to our ideal, and which is coming constant from seed.

Part of the crop that we are growing this fall belongs to the 10th generation. Up to and including the 4th generation was grown at the Ontario Agricultural College.

Up to the present we have not distributed any quantity of seed as we have not enough for general distribution, although we have sent out several small lots to growers for trial under commercial conditions. To date we have not had full reports on these but a few that we have heard from report quite favorably.

We have in this new variety a cucumber that runs 8 to 10 inches long and about 2 inches in diameter. It is mostly smooth and straight without any neck and carries its thickness well from end to end. It is a good dark green. It sets fruit quite freely, some plants producing 30 good fruits without artificial pollenation and about one-third of these are borne on the upright stem. Its flavor and texture are good, being rather tougher than the English parent but not as coarse as the White Spine type.

To prevent pollenation by bees the ventilators were screened.

The plants of the earlier generations did not set their fruits freely. Out of 33 plants grown of the 5th generation only 7 set one or more fruits without pollenation and most of them were black spines; however, as before mentioned, we found one white spine which is the basis of our new strain.

We also carried on some of the black spine, thinking we might possibly get a desirable white from them, but nothing worth while developed.

It would seem that the yield per plant has been increased by elimination of the poor yielders. Each new generation has been selected from the best yielding plants. In other words we have been isolating plants possessing the free setting character from the mass of characters of the original hybrid, and along with this free setting we have managed to get the other desirable characters. Improved cultural methods and reduction in the number of seed fruits saved on each plant have also helped to increase the yield.

In sowing the seed we put one seed into a two inch pot. By covering with glass and shading, the seeds are up in three or four days, and are ready to plant out in

the beds about ten days later without any intervening transplanting. As soon as the young plants show through the soil they are given full sunlight and from then on do not get any shade at all. They are planted in solid beds. Our beds being a little over five feet wide we set three rows of plants, placing them alternately so that the best use is made of the ground space. The plants are trained to a single stem secured to a bamboo until the overhead wires are reached at 6 feet. Here they are allowed to develop two main laterals which are trained along the wires. The side shoots that come from the main stem, and the laterals, are pinched back to the first leaf beyond the first fruit. As soon as the wires are covered the ends of the laterals are pinched back, as are all the young hoots that break out from the laterals, and when the vines are growing vigorously this is an endless job as every joint seems able to send out several shoots.

While the cucumber is not a staple article of food yet it is a profitable crop to grow, as there is a good demand for it at good prices, and we think that with improved varieties it will easily hold its own with other greenhouse crops.

Elementary Bacteriological Instruction in our Public and High Schools

By DAN H. JONES,
Professor of Bacteriology, Ontario Agricultural College, Guelph.

(Paper read at the National Public Health Convention, Toronto, May, 1921.)

Bacteriology is the youngest of the natural sciences. Though it is more than two hundred years since Leeuwenhoeck first observed and tentatively described certain unicellular microorganisms, it was not until after the middle of the last century that such minute forms of life were demonstrated to have any economic significance. Then with the pioneer work of Pasteur, Koch, Lister, Warrington, Beyerinck, Winogradsky and others, it became apparent that human welfare was enormously influenced by their activities. It was found that they were responsible for the various infectious and contagious diseases of man and animals; that they were the agents of fermentation, putrefaction and decay, inducing spoilage of food materials not properly protected; that many species were necessary in the soil to elaborate the plant food for growing crops; that certain very destructive plant diseases were due to their ravages within the plant tissues: that they were inseparably connected with all forms of life, some being injurious to life, others not only beneficial but absolutely essential, either directly or indirectly. These were revolutionary truths, the discovery of which, as the result of much patient research work on the part of a small but gradually increasing number of investigators, resulted during the last thirty or forty years in the establishment of the science of bacteriology. As a result of these labors there is now available a wealth of valuable information regarding the nature, occurrence and significance of microorganisms. This information is imparted in relatively small doses at certain of our specialized higher educational institutions, as for instance the medical, veterinary and agricultural colleges and schools of hygiene. While, however, the pursuit of the science of bacteriology as a vocation will necessarily always be the work of the specialist it is eminently desirable that not only the relatively small number of individuals attending such institutions as above mentioned should get some training in the science, but that every member of the community should be taught a few at least of the elementary but fundamental truths which the science has demonstrated.

Within the last few years something has been done towards this end by occasional articles in the daily papers, by the publication of circulars and bulletins, by public lectures and demonstrations, as for instance

in the tuberculosis campaign of a few years ago, and by popular exhibits at our National Exhibition and other places of public resort. These efforts, however, whilst they have undoubtedly accomplished much good, are only spasmodic and at best influence only a small fraction of the general public.

How then shall the public be reached?

In the opinion of the writer the best, if not the only method to attain this end is to have a little elementary bacteriology taught in our public and high schools.

About ten years ago the Ontario Department of Education decided to give those public and high school teachers who wished it, more particularly those from rural districts, a summer school course in elementary agriculture so that the subject might be taught in the rural schools. Every summer since then we have had at the Ontario Agricultural College, Guelph, several hundred of such teachers taking two years summer school courses. In each of the courses some bacteriology is given—to the elementary or public school teachers about ten lectures and demonstrations and to the intermediate or high school science teachers a laboratory course. To all these students, on arrival, the subject of bacteriology is absolutely new but the interest they evince in the work as it progresses is a source of gratification to the instructors, and from the nature of the questions asked and remarks made it becomes evident that in the future these students will be more particular with regard to hygienic measures, as in the handling of milk and in the cleansing and sterilization of milk containers; in the canning of fruits and vegetables they will work not by haphazard and rule of thumb but with greater confidence from understanding the underlying principles concerning the nature and control of molds, yeasts and bacteria; in association with cases of infectious diseases they will be more ready to fall in with the directions of the sanitary inspector or M. O. H., and so curtail the danger of spreading disease in the community.

Three years ago the Ontario Department of Education decided that the School Inspectors should take the Summer School Course in Agriculture, so that they might be conversant with this new phase of work in the rural schools.

When the first batch of sixty inspectors came in for their bacteriology they expressed some surprise that the subject should be required, as they had not received it even in their university science course. Before the first period was over, however, all the members of the class seemed to realize the importance of the truths propounded and their application to daily life, and were keenly eager to get all the time and attention that we could give them during the rest of the course. At the end of the last period they were asked to submit at their leisure a brief note expressing their views as to whether or not some elementary bacteriology should be taught in our public and high schools and the reasons for their views. Every member of the class complied with the request and an examination of their papers showed they were most enthusiastic in their support of the movement and unanimously of the opinion that the subject should be on the curriculum.

In the early months of the present year the staff of the O. A. C. was requested by the Ontario Department of Education to revise the science course in agriculture for high schools. In this revision it was decided to introduce some bacteriology, the subject to be taken in the Lower School the first year, under the headings:

Bacteria: What they are and where they occur.

Relation to—

Foods: Experiments to show pasteurization and sterilization of milk and of canned foods.

Water Pollution: Spread of such infectious diseases as typhoid fever; purification of water by boiling; use of chloride of lime as a disinfecting agent.

Infectious Diseases as tuberculosis, typhoid fever, diphtheria; discussion of the agents of transmission, as house flies, drinking cups, etc.

The course as here outlined may not be as complete as is desirable, our original suggestions on the matter having been somewhat reduced in the final revision by the general committee appointed for the task. But it is a beginning, though it applies only to the limited number of students in high schools who elect agriculture

as their science subject. As, however, the importance of the subject is more generally perceived by those having the future modification of our school curricula, let us hope they will realize the desirability of having a few, at least, of the fundamental elementary truths of the science of bacteriology taught in all schools. This, of course, would mean that the teachers should get some bacteriology in their preparatory training. Such may be difficult to achieve at first. With us at the Agricultural College it was a comparatively simple matter to modify our course in general agricultural bacteriology to meet the needs of the Summer School student teachers getting their training in elementary agriculture. But the problem should not be insuperable. The Departments of Bacteriology or Zymology at the University might be able to meet the needs of the case.

When we bear in mind that the life of every individual, whether he knows it or not, is most intimately associated with microorganisms from the hour of birth until the hour of death, and that his well being may be profoundly modified for weal or woe by such association, it seems nothing short of criminal neglect for our educational authorities to refrain longer from including something of the science of bacteriology amongst the subjects taught in our elementary and high schools as well as in certain of our higher educational institutions.

DISEASES OF THE POTATO.

It has been suggested that a series of articles dealing with diseases of the potato would be acceptable to readers of *Scientific Agriculture* and in view of the importance of the potato crop the series should be a useful one. Prof. B. T. Dickson has consented to prepare the series, the first part of which appears in this issue.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

AN APOLOGY.

In preparing the report of the first annual Convention of the Canadian Society of Technical Agriculturists, which was held at Winnipeg in June last, an unfortunate and regrettable omission was made. The report was prepared hurriedly in order that it might be published in the June issue of *Scientific Agriculture,* and probaly lack of time or space, or both, accounted for the omission of one important courtesy extended at the Convention.

On the occasion of the invitation which was extended to the delegates and members, to attend a banquet at the Manitoba Agricultual College on June 16th, the Provincial Department of Agriculture very kindly arranged for the preparation of a souvenir menu. This souvenir was given to each of those who attended the banquet and it will doubtless be carefully preserved, not only as a remembrance of a most enjoyable evening but also as something emblematic and typical of the Canadian west.

This souvenir was prepared by Miss E. Cora Hind, agricultural and commercial Editor of the Manitoba Free Press, and the interesting and statistical marginal references to historical incidents in western Canadian history, as well as the many quotations used in presenting a "Manitoba banquet", must have entailed a great deal of effort and a vast amount of reading.

Forgetfulness and oversight, and not lack of deep appreciation, accounts for the delay in acknowledging this courtesy.

ALBERTA REPRESENTATIVE ON DOMINION EXECUTIVE.

Mr. H. A. Craig, Deputy Minister of Agriculture for Alberta, has been appointed to represent that province on the Dominion Executive of the C. S. T. A. for the current year.

Notice to Secretaries

It is probable that nearly every local branch will hold a meeting before the next issue appears. For that reason, it is desirable that any matters requiring consideration should be brought to the attention of local secretaries now.

SUBSCRIPTIONS.

All new subscriptions are now placed to the credit of the Society, and for that reason every member should take a personal interest in increasing circulation. At an early date local secretaries will be furnished with subscription forms, which should be distributed to members at the first meeting, or forwarded to each member by mail. There is no reason why every member should not be able to secure two or three new subscribers to the magazine.

MEMBERSHIP FEES.

The finances of the Society are greatly handicapped by the fact that quite a number of the members have not yet paid their fee for the current year. This, in most cases, is due to oversight, and an occasional reminder from the local secretary will bring results.

It is, of course, understood that 20 per cent of every membership fee is retained by the local branch for its own use. This should be applied to cover the cost of postage, local meetings and any other items of expense incurred through the operations of each branch.

CORRESPONDENCE.

Frequent communications to the General Secretary are desired. Full particulars regarding meetings, advance notices of same, news of members, changes in addresses, and any other items, are of the greatest interest. In many instances these items can be published to advantage in the official organ.

NEW MEMBERS.

A special and continuous effort should be made to enrol new members. This can be done to better advantage by the local branches than from the office of the General Secretary. It would be appreciated, however, if the local secretaries would furnish the General Secretary with the names and addresses of prospective members in order that an additional appeal may be made from his office.

ARTICLES.

The appearance of the magazine will be greatly improved when it is possible to publish more material. At the present time an effort is being made to keep the cost of publication as low as possible. When finances warrant, more articles will appear in each issue. At the present time, the usefulness of the Editorial Board is restricted because the number of articles received for publication is not sufficient to permit their absence for review by members of the Board. When more articles are available this difficulty will be overcome. Members should be encouraged to submit articles whenever possible.

FINANCES.

The finances of the Society are in sound condition, and the responsibilities involved in the ownership of *Scientific Agriculture* have not as yet proved too serious to bear. If every member promptly pays his renewal membership fee, the financial difficulties of the Society will be overcome. Members who wish to obtain full particulars regarding the finances of the Society, can do so upon application to the General Secretary.

CHANGES IN ADDRESSES.

The following changes have recently been made in the addresses of members:

Dr. James W. Robertson, 474 Wilbrod St., Ottawa.

Oscar Descostes, Waterloo, P.Q.

J. A. Ste-Marie, Exp. Farm, Ste-Anne de la Pocatiere, P.Q.

APPLICATIONS FOR MEMBERSHIP.

The following applications for membership have been accepted:

Dr. C. B. Clevenger, Agricultural College, Winnipeg.

C. P. Marker, Dairy Commissioner, Edmonton.

Stanley Wood, Moncton, N.B.

EASTERN ONTARIO LOCAL BRANCH

The two local branches in Ontario, one with headquarters at Guelph for western Ontario, and the other at Ottawa for eastern Ontario are, numerically, the largest branches in the Dominion and each contains about 90 members. The eastern Ontario branch is again planning to hold fortnightly meetings at the University Club and a Programme Committee will be appointed to arrange the series. It is unlikely that any meetings will be held until the latter part of October.

MACDONALD COLLEGE LOCAL BRANCH.

It has been finally decided to hold the first of the 1921-22 meetings at Macdonald College on October 20 and 21 inclusive. A very interesting programme has been drawn up and submitted to the members. It is not anticipated that many changes will have to be made.

The programme is devoted mainly to extension problems, and speakers have been obtained to represent federal, provincial and local aspects of those problems, as affecting the Province of Quebec.

Time is being given to a consideration of the Departmental activities at Macdonald College, both in field and laboratory and visits to these departments will be included in the programme.

There is every indication of a good attendance, not only of the members who are resident at the College, but also of those located in other parts of the Province. A further report of this meeting will be published next month.

FRENCH LOCAL BRANCHES.

A joint meeting of the Montreal and Quebec local branches is being arranged and will be held in Quebec City at the time of the Plowing Match, about the middle of October. Present arrangements are only tentative and the programme will be based upon suggestions now being solicited. Further notice appears in the French section of this issue.

A SERIOUS CATTLE PEST.

Great Loss Caused by the Activities of the Warble Fly.

One of the most trying insect pests that infest cattle is the Warble fly. It not only irritates the cattle to a marked extent, but it weakens the milk flow, badly affects the flesh and destroys the value of the hide. By its pertinacity and viciousness it thus causes enormous loss to the breeder, the farmer, and to the vendor of products derived from live stock. The loss caused cannot be estimated with even approximate exactness, but some idea of it may be gained from the fact that responses received to enquiries made under instruction of the Veterinary Director General of the Dominion show that the loss in hides damaged by Warble flies runs to from 25 to 30 per cent. Tanners claim that hides thus damaged are dear at almost any price. They are agreed that rough, long-haired, ill-kept animals are the most subject to the pest, well-fed, sleek, well-cared for animals being generally immune. Thus the presence of the Warble fly is fairly good evidence of neglect. A bulletin prepared and written by the Chief Animal Pathologist of the Health of Animals Branch at Ottawa, dealing with the subject, states that there are two classes of the fly, one known as *Hypederma lineatum,* which lays its eggs around the cornet, fetlock, knees and hocks, during the latter part of April. The second is known as *Hypoderma bovis,* which attacks the hindquarters and legs in June, but continues active for over fifty days, while *H. lineatum* limits its activities to eighteen days. The story told in the bulletin is of investigations started at Agassiz, B.C. in 1911, and conducted for a number of years, the object being to discover means for eradicating the pest, reveal its methods and habits, and show the damage and loss it causes. In summing up, the author says that animals should be housed during the heat of the day to prevent the flies attacking them and laying their eggs, and that the grubs should be squeezed out as early as possible.

La Loi de la Moyenne Arithmétique et le Chaume Idéal

GEORGES MICHAUD,

Rédacteur au Bulletin des Agriculteurs.

C'est en 1885 que Nowacki, alors professeur d'agronomie au Polytechnicum fédéral Suisse, à Zurich, au cours d'observations minutieuses sur le développement de la plante de seigle, découvrir la corrélation qui existe entre les longueurs des entre-noeud des chaumes de céréales.

Il avait entrepris un étude détaillée sur la manière dont se développaient les entre-noeuds, au cours de laquelle il les avait mesurés exactement à différents stages de leur développement.

Le résultat de ses observations démontrait clairement que les entre-noeuds se développent de bas en haut, c'est-à-dire que l'entre-noeud inférieur pousse le premier, puis celui qui lui est directement superposé et ainsi de suite, jusqu'au sixième, qui supporte l'épi.

Les mesurages obtenus sur le champ révélaient déjà une certain proportion fixe entre les longueurs des entre-noeuds, tel que le démontre le tableau suivant:

Période de développement	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII
Date, 1885	du 1er au 15 avril				18 avr.	23 avr.	28 avr.	2 mai	9 mai	16 mai	22 mai	31 mai
Longueur du 1er	centimètres				cm.	cm.	cm.	cm.	cm.	cm.	cm.	cm.
entre-noeud	0.80	0.7	1.1	1.0	1.9	1.6	1.7	1.6	1.4	1.6	1.0	....
2ème ..	0.45	5.2	9.0	8.2	12.2	14.0	15.3	10.0	10.5	11.2	12.0	....
3ème ..	0.08	1.7	7.0	13.5	21.0	23.5	25.9	23.8	23.1	21.1	21.3	....
4ème ..	0.04	0.4	1.0	2.1	11.4	22.1	28.0	33.0	35.6	32.6	35.5	....
5ème ..	0.02	0.2	0.4	0.6	2.1	10.2	15.1	23.8	32.2	40.1	46.7	....
6ème ..	0.01	0.3	1.5	4.8	7.1	16.0	19.3	26.0	33.6	42.6	46.0	57(?)
Long. de l'épi	0.55	5.2	9.4	10.5	12.5	12.0	12.7	12.6	12.6	12.6	13.9	....
Total	1.95	13.7	29.4	40.7	68.2	99.4	118.0	131.0	149.0	162.0	178.4	189.4(?)

Le 15 de mai, un tombée de neige tardive versa le champ d'expérience, la plupart des tiges fûrent pliées, beaucoup fûrent même cassées aux noeuds inférieurs.

Il ne restait que peu de matériel apte à continuer les observations, lesquelles cependant avaient déjà une certaine valeur, puisqu'à cette date, la pousse était à peu près terminée.

Si nous considérons les chiffres du tableau à cette époque (16 mai) qui donnent la moyenne des mesurages de 5 chaumes, nous remarquons que la longueur du 2ième entre-noeud est égale à la moyenne arith-

MOYENNE DES MESURAGES DE 5 CHAUMES

LONGUEUR DU 1er ENTRE NOEUD 1.6 cm		Moyenne arithmétique	Différence entre la moyenne exacte et la moyenne trouvée
" 2ième	11 2	$\frac{(1\ 6 + 21.3)}{2} = 11\ 45$ cm	0 25 cm
" 3ième "	21 3	$\frac{(11\ 2 + 32\ 6)}{2} = 21\ 90$ "	0.60
" 4ième "	32 6	$\frac{(21\ 3 + 40.1)}{2} = 30.70$ "	1 90
" 5ième "	40.1	$\frac{(32\ 6 + 42\ 6)}{2} = 37\ 60$ "	2 50
6ième "	42 6		

métique de la longueur du 1er et du 3ième entre-noeud.

Il en est de même de la longueur du 3ième entre-noeud. Quand au 4ième et au 5ième entre-noeud, leur longueur se rapproche seulement de la moyenne arithmétique de la longueur de l'entre-noeud directement inférieur et de l'entre-noeud directement supérieur.

Des écarts de 1.9 et 2.5 cm, Nowacki conclut que les plantes **n'avaient pas terminé** leur croissance.

Il se met en quête d'autre matériel et trouve le 2 juin, sur un champ de seigle versé, une touffe de plantes, les seules qui étaient restées debout sous le poid de la tombée de neige du 15 mai. Il admet de prime abord qu'elles sont "normales" quant aux proportions des longueurs des entre-noeuds, et il les emporte à son laboratoire pour les examiner.

Le tableau suivant donne les résultats de **ses mesurages.**

	PLANTES (1)	(2)	(3)	(4)	Moyenne pour ces 4 plantes
Longueur du 1er entre-noeud .. .. .. cm.	4.1	2.8	2.5	3.0	3.10
" 2ème "	13.1	13.2	11.6	9.0	11.72
" 3ème "	21.3	20.0	21.5	19.2	20.50
" 4ème "	31.0	33.9	26.4	26.0	29.32
" 5ème "	46.7	39.2	38.6	37.2	40.42
" 6ème "	53.2	47.1	55.5	51.1	51.72

La loi était trouvée. Nowacki la formula comme suit:

La longueur de chaque entre-noeud d'un chaume normal ou idéal est égale à la moyenne arithmétique des longueurs des deux entre-noeuds voisins.

La preuve:

		moyenne calculée	moyenne mesurée
2ème entre-noeud	(3.10 + 20.50) ÷ 2 =	11.80 cm.	11.72 cm.
3ème "	(11.72 + 29.32) ÷ 2 =	20.52 cm.	20.50 cm.
4ème "	(20.50 + 40.42) ÷ 2 =	30.46 cm.	29.32 cm.
5ème "	(29.32 + 51.72) ÷ 2 =	40.52 cm.	40.42 cm.

Ces moyennes, calculées et mesurées, sont aussi mathématiquement exactes qu'on peut l'exiger, ne différant que par des fractions de centimètres. Elles démontrent indubitablement que la nature construit le chaume en proportions harmonieuses, qui lui donnent la plus grande flexibilité et la plus grande solidité.

La loi, du reste, s'applique également et avec tout autant d'exactitude aux gaines des entre-noeuds, comme nous le révèlent les mesurages de celles-ci:

	desséchée	moyenne calculée
Longueur de la 1ère gaine		
" 2ème "	11.65 cm.	.....
" 3ème "	14.52 cm.	14.70 cm.
" 4ème "	17.75 cm.	17.14 cm.
" 5ème "	19.77 cm.	19.65 cm.
" 6ème "	21.55 cm.	.....

LA SOLIDITE RELATIVE DES ENTRE-NOEUDS.

Cependant la longueur relative des entre-noeuds n'est pas le seul facteur de leur construction. Leur solidité relative en est un autre également important.

Cette solidité dépend principalement de la circonférence du chaume et de l'épaisseur de ses parois, partiellement aussi de l'épaisseur des gaînes qui l'entourent.

La solidité relative des différents entre-noeuds et de leurs gaînes se détermine le plus facilement au moyen de leurs poids, qui donne la meilleure idée de la quantité de matériaux qui entrent dans la construction de ces organes et qui concourent à la formation et à l'épaisseur des cellules.

Se basant sur ces avancés, Nowacki pesa exactement, après les avoir fait sécher à l'air, les entre-noeud et les gaînes de chacun des quatre chaumes qu'il avait mesurés en dernier lieu, voici ce qu'il obtint:

Poids en grammes.
(moyenne de 4 chaumes)

	Entre-noeuds — 1er	2ème	3ème	4ème	5ème	6ème
a) entre-noeud	0.17	0.46	0.63	0.68	0.59	0.38
b) gaine	..	0.10	0.17	0.21	0.21	0.16

Pour établir la relation qui existe entre les poids et les longueurs de ces différents

organes, il suffit de rapporter les premiers aux seconds. On obtiendra ainsi le poids par unité de longueur, par mètre, par exemple:

Poids en grammes par mètre de longueur.
(moyenne de 4 chaumes).

	Entre-noeuds —					
	1er	2ème	3ème	4ème	5ème	6ème
a) entre-noeud	5.48	3.92	3.07	2.32	1.46	0.73
b) gaîne	..	0.86	1.17	1.18	1.06	0.74
(a + b)	5.48	4.78	4.24	3.50	2.52	1.47

Un examen des poids par mètre dénote la même régularité de moyenne arithmétique pour les entre-noeuds et pour le total "entre-noeud et gaîne" (a + b) que nous avons observée dans la longueur des entre-noeuds et des gaînes, séparément.

On peut donc en déduire la loi suivante: "*Le poids de chaque entre-noeud par unité de longueur est égale à la moyenne arithmétique du poids des deux entre-noeuds voisins.*"

Ou ce qui revient au même: "*La solidité des entre-noeuds diminue de bas en haut, de telle sorte que la solidité de chacun des entre-noeuds représente la moyenne de celle des entre-noeuds voisins.*

Les chiffres obtenus corroborent la loi:

a) Entre-noeuds seuls.
(grammes par mètre)

	1er	2ème	3ème	4ème	5ème	6ème
Trouvé	5.48	3.92	3.07	2.32	1.46	0.73
Moyenne arithm.	..	4.27	3.12	2.26	1.52	..
Différence	..	0.35	0.05	0.06	0.06	..

b) Gaînes seules.
(grammes par mètre.)

	1ère	2ème	3ème	4ème	5ème	6ème
Trouvé	..	0.86	1.17	1.18	1.06	0.74

(a + b), Entre-noeuds avec gaînes.
(grammes par mètre.)

	1er	2ème	3ème	4ème	5ème	6ème
Trouvé	5.48	4.78	4.24	3.50	2.52	1.47
Moyenne arithm.	..	4.86	4.14	3.38	2.48	..
Différence	..	0.08	0.10	0.12	0.04	..

Des tableaux ci-dessus ressortent clairement les faits suivants:

a) La solidité des *entre-noeuds,* mesurée par leurs poids par unité de longueur, répond parfaitement à la loi de la moyenne arithmétique pour les 2ème, 3ème, 4ème, 5ème et 6ème entre-noeuds. Le premier entre-noeud y répond aussi mais il est un peu trop fort en comparaison du 2ème et du 3ème. La raison en est que la première gaîne et desséchée et qu'elle ne contribue plus à solidifier la tige; c'est pourquoi ce premier entre-noeud, qui doit supporter le fardeau tout seul, est plus fortement développé.

b) La solidité des *gaînes seules* ne répond pas à la loi de la moyenne arithmétique: du bas au milieu du chaume elle augmente et du milieu au haut du chaume elle diminue.

a+b) C'est pourquoi il est d'autant plus extraordinaire, à première vue, que la solidité des *six entre-noeuds avec leurs gaînes* correspond presque mathématiquement à la loi.

En amalgamant les deux lois que nous avons énoncées plus haut, Nowacki établit la loi double suivante:

Dan le chaume normal, la solidité des entre-noeuds diminue de bas en haut dans la même proportion que leur longueur augmente.

Cette loi pouvait aussi être traduite comme suit:

Chaque entre-noeud d'un chaume normal est la moitié aussi long et la moitié aussi solide que les deux entre-noeuds voisins ensemble ou bien on pourrait aussi dire: *De bas en haut la solidité des entre-noeuds d'un chaume normal diminue, leur longueur augmente, de telle sorte que chaque entre-noeud, dans sa longueur et dans sa solidité, tient le milieu entre les entre-noeuds voisins.*

Il est vrai qu'en réalité on ne trouve pas de chaume qui soit construit absolument suivant ces lois, mais tous s'en rapprochent plus ou moins. La loi n'est donc applicable *qu'au chaume normal.* Elle nous dit *comment ce chaume devrait être construit et divisé pour être normal ou idéal.*

Elle nous indique donc aussi comment nous devons sélectionner les plantes afin d'obtenir des chaumes qui, avec la plus petite dépense de matériel poossible, soient le plus solide possible, capables de supporter les épis les plus pesants sans danger de verse.

Ces principes n'étaient pas connus avant la découverte par Nowacki de cette loi qui a donc, à côté de son intérêt scientifique, une valeur pratique de laquelle il faut tenir compte dans nos travaux de sélection.

L'Agriculture et la Desertion des Campagnes

Par J.-A. STE. MARIE, propagandiste en Industrie animale.

On parle beaucoup, depuis quelques années, d'exode rural. Ce mouvement, sans doute, est dû à des causes multiples. Nous voulons, dans cet article, dire un mot de l'une d'entre elles, la principale d'après nous, les faibles rendements d'un trop grand nombre de fermes.

C'est là, nous osons le croire, la cause primordiale de la désertion des campagnes.

Sur les fermes progressives, les jeunes gens ne parlent pas ou parlent rarement de s'en aller en ville. Ils ne pensent pas à quitter le confort qui règne à la maison pour des lendemains incertains. D'un autre côté, sur les fermes qui rapportent peu ou qui font moins que payer leur propriétaire, on rencontre une autre mentalité. L'agriculture ne paye pas parce qu'on ne sait pas la rendre payante et on l'abandonne.

Pour établir que ce sont les faibles revenus qui provoquent le délaissement de la terre, laissez-moi vous citer le résumé d'une enquête que j'ai faite en 1920, sur 302 fermes, dans six comtés de la province de Québec.

Résultat moyen de 302 fermes

Grandeur moyenne, arpents	128
Capital total, moyenne	$18.649.00
Unité animale, moyenne	24.5
Revenu par unité animale, moyenne	$ 87.73
Récoltes vendues, moyenne	$ 754.00
Rapport total, moyenne	$ 2,830.00
P. C. de revenu brut, moyenne	15.2
Dépenses totales, moyenne	$ 2,492.00
P. C. de dépenses totales, moyenne	13.4
Part du travail au revenu net, moyenne	$ 338.00

Vous avez remarqué que ces fermes représentent en moyenne un capital de $18,-649.00 qui a rapporté 15.2 pour cent de revenu brut. Les frais d'exploitation (comprenant un intérêt de 6 pour cent sur le capital, etc., etc., mais non le salaire du cultivateur) s'élevant à 13.4 pour cent, il reste une balance 1.8 pour cent ou $338.00 comme revenu moyen ou salaire par cultivateur pour le travail qu'il fait avec sa femme et les enfants de moins de quinze ans, sur sa ferme.

Si le revenu est bas pour l'ensemble de ces fermes, on trouve, par contre, un nombre assez considérable de cultivateurs qui administrent leur ferme sur une base plus commerciale, d'après les dernières données de la science agricole, et qui réussissent à se faire un salaire leur permettant de vivre plus largement et d'inculquer à leurs enfants, à part les notions agricoles, l'amour de la vie rurale.

Laissez-moi vous citer un autre tableau analysant l'exploitation de cinquante fermes les mieux administrées et de cinquante autres moins bien administrées.

Résultat moyen et comparatif de deux groupes de 50 fermes chacun.

Nombre de fermes	50	50
Grandeur moyenne, arpents	134	130
Capital total, moyenne	$16367.00	$15003.00
Unité animale, moyenne	27.6	23.3
Revenu par unité animale, moyenne	$ 88.22	$ 65.06
Récoltes vendues, moyenne	$ 1445.00	$ 408.00
Rapport total, moyenne	$ 3880.00	$ 1924.00
P. C. de revenu brut, moyenne	23.7	12.8
Nombre d'acres requis par unité animale	4.5	5.6
Coût d'exploitation par acre, moyenne	$ 20.35	$ 20.35
Rendement en lait par vache, moyenne, lbs.	5210	4270
Revenu par vache, moyenne	$ 130.00	$ 95.00
Dépenses totales, moyenne	$ 2728.00	$ 2646.00
P. C. des dépenses totales, moyenne	16.6	17.6
Part du travail ou revenu net, moyenne	+ $ 1152.00	— $ 722.00

Comme vous le constatez d'après les chiffres cités, les cinquantes fermes les mieux administrées obtiennent en moyenne un revenu net de $1152.00, tandis que les cinquante autres obtiennent un déficit moyen de $722.00. C'est sur ces fermes, nous en avons la conviction, que se trouve et réside le grand problème de la désertion de la campagne. Là où il n'y a pas de revenu, la nécessité d'obtenir de l'argent pour rencontrer les obligations de la vie obligent ceux qui sont dans ce cas, de regarder où ils peuvent en obtenir et alors, on va dans les chantiers, dans les viles, aux Etats-Unis, n'importe où, où l'on pourra obtenir l'argent nécessaire pour faire face aux éventualités qui se présentent. Remarquez que cette différence de revenus entre les deux groupes de fermes n'est pas due à une question de superficie ou de capital engagé puisqu'il y a très peu de différence entre les deux groupes sur ces deux points, mais bien à l'administration de ces fermes. Que l'on étudie ce tableau comparatif et l'on réalisera pourquoi certains cultivateurs sont satisfaits, tandis que d'autres ne le sont pas.

Que chacun se trace un programme d'action, que tous visent à améliorer le rendement de la terre, la qualité et le rendement de ses animaux en pratiquant un élevage plus rationnel et en fournissant une alimentation plus libérale à ses vaches; que tous pratiquent le contrôle laitier et la comptabilité; que tous accordent un peu d'initiative à chacun de leurs enfants en leur permettant de s'intéresser d'une manière particulière à une branche d'exploitation quelconque de la ferme et on aura beaucoup fait pour enrayer l'exode rural.

Les Facteurs de la Production

Par GEORGES VALOIS

Contrairement à ce que l'on croit communément, la production n'est point le résultat de l'action combinée de ce que l'on appelle "le travail et le capital," ni de l'action de ces trois seuls facteurs "intelligence, capital, travail"; ni de l'action de ces deux facteurs "technique et main-d'oeuvre". Les hommes bien ou mal intentionnés qui veulent assurer la paix sociale par l'union du capital et du travail perdent leur temps, car ils s'occupent d'unir deux facteurs qui sont, à eux seuls, tout à fait impuissants; ceux qui veulent équilibrer l'intelligence, le capital et le travail ne sont pas beaucoup plus éclairés: quant à ceux qui veulent assurer la production par la seule collaboration de la technique et de la main-d'oeuvre, ils ont de la limaille de fer dans les yeux.

Les facteurs de la production sont plus complexes et si l'on en veut supprimer un, il n'y a pas de production possible. Mais je me hâte de marquer que, de tous, c'est le capital qui joue le rôle le moins important et que, d'ailleurs, c'est lui qui, ainsi qu'il est juste, est le moins rémunéré.

La production est le fruit d'une collaboration *hiérarchisée* dont les facteurs sont plus nombreux que ne le supposent la petite science des libéraux et l'ignorance épaisse des socialistes.

En premier lieu, vient la *conception*, oeuvre de l'*imagination créatrice*, par laquelle un homme, capitaliste ou non, technicien ou non, conçoit une utilisation de l'effort humain, son organisation, son mode de réalisation et son rendement.

En second lieu, le *commandement*, aptitude du même homme ou d'un autre à réaliser les conceptions de l'esprit, à maintenir les hommes dans les voies et moyens de réalisation, à coordonner les efforts pour diriger la technique et la main-d'oeuvre vers le but cherché; l'aptitude au commandement est presque toujours soutenue, chez le même homme, par les aptitudes organisatrices ou administratives; mais ces aptitudes sont secondaires: dans toute entreprise, la fonction essentielle est celle du commandement qui crée et fait observer la discipline indispensable du travail, laquelle n'est jamais librement consentie;

Ensuite, intervient l'*intérêt personnel*, moteur absolument nécessaire de l'activité du chef qui a conçu et qui commande, et grâce à quoi le chef acceptera de s'imposer à lui-même l'effort de direction et d'or-

ganisation que nécessite la réalisation de ses conceptions.

Alors se manifeste la *technique,* c'est-à-dire le choix des moyens et procédés de travail, ou la recherche des hommes spécialisés dans la connaissance de ces procédés et moyens;

Enfin, la *main-d'oeuvre* agit conformément aux directions générales et techniques des facteurs qui précèdent et elle reçoit immédiatement le prix de sa peine, par l'utilisation qui est faite:

Du *capital,* dont le rôle est passif dans la création économique, car il ne fait que se prêter, se lour, ou se faire employer. A ce titre, il ne vient qu'en dernier lieu, et, aussi bien, il n'est jamais rémunéré qu'après tous les autres facteurs de la production. Le capital redevient actif, toutefois, pour le contrôle de l'entreprise, pour l'appréciation des résultats, et, selon le rendement, il s'engage plus fortement, ou se retire, quand il le peut.

Ces facteurs peuvent être distincts par les personnes qui les représentent; ils sont fréquemment unis en de mêms personnes aptes à remplir une ou plusiurs des fonctions de la production.

Si l'on veut bien analyser sans péjugés le fonctionnement de la production, on s'apercevra que l'ordre *hiérarchique* de ses facteurs est bien celui qui est présenté ici, non seulement dans la création, mais encore dans la rémunération.

Contrairement aux affirmations des socialistes, le capital proprement dit (c'est-à-dire les hommes qui ne sont pas capitalistes) ne gère, ne contrôle, ni ne commande la production, et il n'est rémunéré que pour le pr|t qu'il fait de lui-même ou pour le risque qu'il consent à courir. Lorsque le capital paraît jouer un rôle plus important, c'est qu'il appartient à un homme ou à un groupe d'hommes qui sont créateurs et chefs d'entreprises en même temps que capitalistes. Le capitaliste, quand il n'est ni créateur, ni chef, ne remplit qu'une fonction, fort importante d'ailleurs: celle d'économe, de conservateur des réserves de produits constitués par les sociétés humaines: c'est un gérant de la fortune acquise, ce n'est pas un artisan de la fortune à créer.

Les vrais maîtres de la production ne sont pas les capitaux, ni les capitalistes. Ce sont les hommes qui sont aptes à employer les capitaux, les leurs ou ceux d'autrui, et qui sont aptes à *diriger* la technique et la main-d'oeuvre. Le capitaliste à qui manque ces aptitudes essentielles ne demeure pas longtemps en possession de ses capitaux. Au contraire, le vrai chef de production peut commencer une entreprise sans capitaux: il ne tardera pas à les conquérir. La rémunération des facteurs de la production doit être faite, si l'on veut que les entreprises prospèrent, selon les indications que fournit la hiérarchie des fonctions:

La main-d'oeuvre est rémunérée selon le temps et la qualité et les risques du travail quotidien exécuté;

La technique est rémunérée selon sa compétence et les améliorations qu'elle réealise dans le temps nécessaire à sa mise en train;

L'intérêt personnel, le commandement, la conception sont rémunérés partie selon le travail effectif qu'ils fournissent, partie selon le rendement de l'entreprise elle-même. Pour ces facteurs, le plus gros intérêt porte sur le rendement net, ainsi qu'il convient, puisque c'est ce rendement seul qui permet d'apprécier lur valeur;

Le capital n'est, répétons-le, rémunéré qu'après tous prélèvements quotidiens, mensuels, annuels, effectués en faveur des facteurs actifs de la production; et c'est seulement dans le cas où il est intimement lié à la conception, au commandement et au risque total que sa part dépasse celle du simple intérêt de l'argent.

La hiérarchie des facteurs de la production peut être observée dans toute entreprise. On peut la regarder comme un fait. Si l'on veut l'expliquer par une loi de la vie, on aura aucune peine à représenter qu'elle ne fait que reproduire dans la vie sociale la hiérarchie des facultés humaines. Que chacun s'observe et il découvrira que le fonctionnement de son être lui donne la loi des entreprises sociales: quand nous nous employons nous-mêmes, c'est d'abord notre esprit, notre imagination, servis par notre intelligence, qui conçoivent l'action; notre énergie commande ensuite, notre intérêt ou nos appétits nous meuvent, notre savoir technique nous sert, et, enfin, notre main manie l'outil sur les matériaux (notre capital) que notre esprit a décidé de risquer ou d'employer.

C'est l'ordre éternel qui est inscrit dans la nature humaine, qui se reproduit dans les oeuvres de l'homme, et contre lequel toutes les insurrections seront éternellement vaines.

FEU M. A.-J.-M. BELANGER

Nous avons appris avec regret la mort de M. A.-J.-M. Bélanger, agronome officiel du Lac St-Jean. Nous offrons à la famille nos plus sincères sympathies. Ne l'oublions pas dans nos prières.

AVIS

La Société des agronomes tiendra une assemblée au mois d'octobre, à l'occasion du concours de labour. On enverra aux membres un avis de convocation.

UN PROGRAMME

Les membres de la Sciété sont priés de faire des suggestions au secrétaire de leur section respective en vue de préparer un programme pour l'assemblée du mois d'octobre.

NUT CULTURE IN BRITISH COLUMBIA.

Experiments Being Conducted with Many Varieties.

Is nut growing on a commercial scale possible in Canada? With a view to securing an answer to this question considerable experimental work is being undertaken on the Experimental Farm at Agassiz, and at the Experimental Station on Vancouver Island, British Columbia. What has been done and what is being done are described in a bulletin by Lionel Stevenson, superintendent of the Sidney station, who says that the few nut trees in some sections of the province that have survived neglect or destruction by animals demonstrate that there are possibilities for systematic nut culture where fruit orcharding has been a success. Numerous fine specimens of the Persian walnut, commonly called the English walnut, are to be seen in the older sections of the Island and in the lower Fraser valley. These, Mr. Stevenson says, would indicate a promise of commercial success. The American species of chestnut, known as *Castanea dentata,* common enough in Ontario and Quebec, thrives on Vancouver Island, but a crop is rarely seen. As a nut it excels the Japanese and European species in flavour, but is not large enough for the trade. Both Japanese and European chestnuts are not unknown on Vancouver Island but lack somewhat in quality. Almond trees have been secured from southern Europe, California, and China, and two trees have produced a good grade of the hard shell type of nut and one of the soft shell kind. Pecans and hickories are being experimented with, British Columbia being outside the range of the wild varieties, and hopes are entertained of success from seedlings procured from Tennessee.

EUROPEAN CORN BORER.

Extension of Area under Quarantine.

As a result of the scouting work for the European corn borer carried on by the Dominion Department of Agriculture it has been found that this insect has spread into new territory this year. On account of the danger of carrying the pest into uninfested districts, a ministerial order was passed on August, 26, 1921, prohibiting the removal of corn, including sweet corn and seed corn on the cob, corn stalks, etc., from the following townships in the province of Ontario:

Charlotteville, Houghton, Middleton, Townsend, Walsingham north, Walsingham south, Windham, Woodhouse in the County of Norfolk; Cayuga north, Dunn, Rainham and Walpole in the county of Haldimand; and Raleigh and Romney in the county of Kent.

This order is supplementary to the order-in-council which was passed on May 18, 1921. All persons desiring detailed information concerning this quarantine should apply to the Department of Agriculture, Ottawa.

: : EDITORIAL : :

IMPORTANCE OF RESEARCH.

The importance attached to agricultural education and research in England is indicated by an announcement recently made by the Right Hon. Sir A. Griffith-Boscawen, Minister of Agriculture. In abandoning the policy of guaranteed prices and control of cultivation, it was stated that the Government was "determined to pursue the policy of education and research as the most permanent method of improving agriculture."

In Canada at the present time there are scores of problems confronting the farmer — and for many years these and new problems will present themselves — which the research worker is attempting to solve. Upon the extent to which agricultural research and education are encouraged and assisted, the rate of progress in the development and improvement of Canadian agriculture will largely depend. At the present time there is too little appreciation on the part of the public, either of the importance of agriculture to the country or of the relationship of science to the industry. This condition will require to be remedied and, in addition, more direct assistance will have to be given to agricultural education and research, before a desirable rate of progress can be attained.

In any organized industry, and particularly those industries which draw upon the natural resources of the country, two distinct divisions must be recognised: the scientific or technical, and the commercial. The details connected with the development of the former division, because they do not come to the direct notice of the public, are not generally known, and for that reason the commercial phases of the industry, having to do with the grading, marketing and selling of agricultural products, are given most publicity. That is probably unavoidable. But the importance of research, and especially to such an industry as agriculture, must not be overlooked, and the preliminary training required by the man who is to carry on agricultural research, must be more generously appreciated. There is a crying need in Canada for qualified research workers in agriculture, but at the present time there is little inducement offered to the man who might wish to enter that field.

The action taken by the British Department of Agriculture is one to be highly commended. When education and research are recognised in Canada as "the permanent method of improving agriculture", and when the required measure of encouragement is given to research workers, the present rate of agricultural development will be materially hastened.

A CLASSIFICATION OF PROFESSIONAL AGRICULTURISTS.

The decision, on the part of the Canadian Society of Technical Agriculturists, to establish a Bureau of Records, deserves every commendation. Although this decision was made only last June, preliminary plans have already been completed, and it is anticipated that the Bureau will be in active operation by January 1st.

There has long been a need in Canada for some available index which could furnish, to interested institutions and firms, a record of the professional agriculturists in this country: their academic standing, their experience and training, and similar information. That such a record has not been available is doubtless due to the fact that the professional agriculturists were not organized, and the C.S.T.A. has already justified its existence by establishing a Bureau of Records.

It is the intention of the Society to include in the active Bureau only the names of its members — regular and associate. This is considered only fair to those who have shown faith in the Society, and to those who continue to give it their direct support. It is anticipated that the membership list will increase rapidly during the next two months and that by the end of the calendar year there will be comparatively few trained agriculturists in Canada whose names will not be recorded.

In the meantime considerable publicity will be given to the fact that such a Bureau is being established and the co-operation of numerous agencies throughout the world will be obtained. Agricultural colleges, experiment stations, governments, technical societies, commercial firms, etc., will be furnished with a complete list of the members, together with the information that the qualifications and training of any member is available, with the consent of the member concerned. It will be further suggested that whenever vacancies occur requiring a technically trained agriculturist, the Bureau be notified. This will assist in ensuring that technical positions are filled by qualified applicants.

There are many ways in which this new Bureau can be a distinctly valuable service to Canadian agriculture. It will probably be some time before it is operating very actively, but its value should soon be demonstrated. And it is obvious that its value to institutions seeking men is just as great as to the men themselves.

Undoubtedly the usual amount of criticism will be forthcoming, because that difficulty always confronts any new enterprise. But if the Bureau is operated solely in the interests of agricultural advancement, fairly and without favour, it will quickly establish itself and be of constantly increasing service.

VARIATION AND INHERITANCE IN RED CLOVER.

One of the most interesting and important articles which has been published in *Scientific Agriculture* is that by Dr. M. O. Malte, commencing in the present issue. It would have been highly desirable to publish the entire article in one issue, but the amount of manuscript prevented that being done. The article has therefore been divided into three parts, which will be published in the November, December and January issues. A list of the available literature on the subject will be published at the end of the third part.

Dr. Malte has devoted a very great deal of time and energy to the collection, translation and arrangement of the material used. The article is a synopsis of the results obtained from red clover investigation work, mainly in Europe, and made available to Canadian readers in the English language. That is a very valuable service, and one that will be greatly appreciated.

BACON PRODUCTION.

A campaign has been undertaken by the Dominion Department of Agriculture, with the object of increasing the volume and improving the quality of Canadian bacon for the English market. A series of advertisements will emphasize, throughout the campaign, the three outstanding features of the export bacon trade: (1) that Great Britain is Canada's only export market, (2) that Denmark is a keen competitor and is now increasing her volume of trade while Canada is not exporting bacon at as high a rate as in 1920, and (3) that by sending forward a steady volume of high quality bacon, Canada can maintain the favour of a discriminating consuming public which was gained during the war years.

The present campaign will do far more towards securing effective results than could have been obtained by any system of circularizing the farmer or furnishing him with the most carefully prepared statistical reading matter. It is sane propaganda which should have been used long ago; it could be used to good advantage for an indefinte period and for various branches of commercial agriculture.

So far as the present campaign is concerned, the importance of securing results cannot be over-estimated. High quality is essential and when keen competition with well-organized Denmark confronts the farmers of Canada, they can ill afford to hesitate. The British market is of comparatively easy access to Danish exporters —a matter of hours in transit as compared to a matter of days when shipping from Canada—and this fact is of course greatly in Denmark's favour. But Canadian bacon was in good favour in England during the war period and Canada can retain that favour by concerted effort. The Dominion Department of Agriculture has taken the right way of stimulating the necessary effort.

Variation and Inheritance in Red Clover

By M. O. MALTE, Ph. D.,
Dominion Agrostologist, Central Experimental Farm, Ottawa.

Red clover (*Trifolium pratense* L.) is, as is well known, an extremely variable plant. In other words, it constitutes a species made up of an exceedingly large number of different morphological and biological types. It presents accordingly a very rich field for investigators and particularly for those interested in research work bearing on heredity and kindred subjects. Under the circumstances it is only natural that a large number of scientists have interested themselves in the study of its peculiarities, especially in reference to variation and inheritance of characters.

As much of the information gained has been published in languages which are not understood by the majority of Canadian agriculturists, the writer has endeavored to bring together in a brief synoptical form the most outstanding results of the principal investigations on Red clover, undertaken in Europe as well as on this continent, giving also a list of the principal literature on the subject. The writer does not claim that the said list is complete; in fact, the writer is aware that several other papers dealing with inheritance in Red clover exist, but as they are not accessible to the writer, reference to them has been omitted. Several lines of investigations have also been touched upon, for instance investigations carried out at the Central Experimental Farm, Ottawa, Ont., bearing on the rather complicated relations between winter-hardiness and perennialism, the reason being that the investigations in question are not yet completed.

I. POLLINATION & FERTILIZATION.

The question of whether red clover can be successfully self-fertilized or not has long been a subject of investigation, the impetus being given by *Darwin* who found that red clover heads protected from visits of bumble bees did not produce a single seed. This discovery of *Darwin's* has by some authors been construed to mean that *Darwin* found that red clover is self-sterile, i.e. that a red clover plant is unable to produce seed if pollinated by its own pollen. Such a conclusion can, however, hardly be drawn from *Darwin's* own account which reads as follows (*Darwin* 1, p. 71) :*

> "From experiments which I have lately tried, I have found that the visits of bees are necessary for the fertilization of some kinds of clover: for instance, 20 heads of Dutch clover (*Trifolium repens*) yielded 2,290 seeds, but 20 other heads protected from bees produced not one; again, 100 heads of red clover (*Trifolium pratense*) produced 2,700 seeds, but the same number of protected heads produced not a single seed."

Darwin obviously means that in the absence of a pollinating agency the formation and the maturing of seed do not take place; he does not say that self-pollination is ineffective.

De Vries (I, p. 939) also found that in the absence of insects red clover refused to set seed. He went, however, a step farther and found that, when red clover flowers were artificially self-pollinated, no seed was obtained. Accordingly, de Vries concluded that red clover in all probability is self-sterile.

Stebler and Schröter (I, p. 73) expressed a similar opinion in 1883 and later qualified the same by stating that Red clover is self-sterile. *Sirrine* (I, p. 89-90) also came to the conclusion that Red clover is self-sterile and so did *Witte* (I, p. 336). *Witte* carried out quite extensive experiments during the years 1905-1908. A total of 79 experiments were undertaken with red clover plants of different origin. In 21 of the experiments the object was to ascertain the effect of pollen on the pistils of the flowers of the same plant, in other words to determine whether red clover is self-sterile or not. All heads used were satisfactorily isolated and numerous crosses made between flowers of the same

* The literature quoted will be given at the end of Part 3, in the January issue.

heads and also between flowers from different heads of the same plant. Not a single germinable seed was obtained in either case. That the pollination method used was quite satisfactory was established by the fact that, when it was employed in crossing flowers belonging to two different plants, well developed germinable seed was obtained. *Witte* accordingly concludes that red clover is perfectly self-sterile, i.e., that a red clover plant can not produce germinable seed unless it is fertilized by pollen from another individual.

Experiments carried out by *H. N. Frandsen* (*Linhard*, I. p. 720) in 1910 and 1911 gave as results that when flowers of the same heads were inter-pollinated only two seeds were obtained from a total of 2,540 flowers, and that, when the flowers were fertilized by pollen from other heads of the same plant a total of 18 seeds were secured from 2,943 flowers, while cross-pollination of heads of different plants resulted in the yield of 959 seeds out of a total of 2,180 flowers. From these results *Linhard* concludes that from a seed grower's point of view the red clover is self-sterile.

Similar results were obtained by *Gmelin* (1) who worked with isolated plants pollinated by bumble bees which, before being let into the isolation cages, were examined and found free from pollen from the outside, and also by *Westgate and Coe* and associated investigators (I, pp. 16-17). The latter found, as a result of experiments conducted in 1911 and 1912, that when flowers of a head were inter-pollinated, an average of 0.16 and 0.09 seed per head were developed in 1911 and 1912 respectively. Flowers pollinated with pollen from another head on the same primary branch did not give a single seed and, when flowers were pollinated with pollen from a head on a different primary branch of the same plant, only one seed from a total of 200 flowers was produced. Cross-pollination between different plants yielded an average of 14.3 seeds per head. From the experiments *Westgate and Coe* and associated investigators conclude that the red clover "is practically self-sterile and that pollen must come from a separate plant in order to effect fertilization".

On the other hand, some investigators claim that isolated and self-pollinized red clover plants may produce seed more or less abundantly. Thus *Meehan* (1), after a study of the flowers in different stages of development, expressed the opinion that red clover was self-fertile. *Armstrong* (1) maintains that there is every reason to believe that numerous individuals belonging to *Trifolium pratense* are self-fertile and that they produce self-fertile progeny (according to *Westgate* and *Coe*, 1, p. 3). *Martinet* (2, p. 5) and *Beal* (1, p. 326) also report self-fertility in red clover. Concerning the findings of *Beal*, however, some doubt may justly be felt as to their correctness. *Beal* states that 50 heads of a plant isolated with mosquito netting and left alone produced a total of 25 seeds, and that 50 heads of another likewise isolated plant with which bumble bees were imprisoned yielded a total of 94 seeds. It may be argued, however, that mosquito netting may not furnish an absolute isolation as smaller insects may gain access to the flowers and bring about pollination by pollen from the outside of the isolation cage. Furthermore the comparatively heavy seed production on the plant on which bumble bees were set to work may readily be explained by the bumble bees bringing with them pollen, deposited on their bodies, from the outside. Under the circumstances, *Beal's* statements appear to carry little weight.

In comparing the evidence available in the matter of the fertilization of red clover, it is apparent that the evidence supporting the contention of self-fertility is very weak and under the circumstances it may be considered justified to conclude that Red clover is normally, if not always, self-sterile.

Varieties.

A great number of more or less well defined varieties of red clover have been distinguished. For the purpose of this paper they may be grouped into three classes, viz.:

Botanical varieties.
Biological varieties,
Geographical varieties.

Botanical Varieties.

Many European botanists distinguish between two main varieties of red clover, viz.: Wild Red clover (*Trifolium pratense L. var. spontaneum* Willk.) and Cultivated Red Clover (*Trifolium pratense L.* var. *sativum* Schreb. & Hopp.). The distinction, however, appears to be a rather uncertain one. Thus, to mention only two authors of recent years, *Witte* (3, p. 51) maintains that the Wild Red clover is more durable, low in stature with smaller leaves and more woody stems than the Cultivated Red clover, while *Lindman* (1, p. 388) describes the wild form as tall, though of a low stature on poor land and in alpine regions.

Whether it really is possible and justifiable to distinguish between wild and cultivated red clover as two botanically separate types, is rather doubtful. From observations made by the writer in Canada it is apparent that if botanical characteristics such as height and mode of growth, size of leaves, etc., were to determine whether various wild-growing plants should be classified with the wild or with the cultivated type, a large percentage of wild-growing red clover plants would have to be referred to Wild Red clover (*Trifolium pratense* var. *spontaneum*). But this can, on the other hand, not be done, for the reason that red clover is not indigenous to Canada, all so-called wild clover plants being descendants from introduced Cultivated Red clover (*Trifolium pratense* var. *sativum*). Under the circumstances it appears that the separation between Wild and Cultivated Red clover as botanically different varieties is a very artificial one. Similar views have long been expressed by certain European botanists, f. i. *Koch* (1, p. 145) who says, after giving a description of *T. pratense sativum*: "Praeterea ne minimam quidem differentiam inter plantam cultam et sylvestrem observavi."

From a practical agricultural point of view the distinction between Wild and Cultivated Red clover as representing essentially different types is also not only difficult to draw, but unessential, for the reasons that, in the first place, all cultivated red clover is nothing but wild red clover introduced into cultivation in comparatively recent historical time, and, secondly, because there are several agricultural "varieties" concerning which it is generally stated that they have been developed by propagation of wild forms. Such varieties are f. i. Cow grass in England, Matten clover in Switzerland, Bullen clover in Western Germany (*Stebler & Schröter*, 2, p. 102), and Toten clover in Norway (*Nielsen*, 1, p. 196).

Systematic botanists generally distinguish between European Red clover (*Trifolium pratense L.* var. *subnudum*) and so-called American Red clover (*Trifolium pratense L.* var. *expansum* W. & K.). The European Red clover is, as the latin name indicates, characterized by having appressed-hairy or almost perfectly smooth stems and petioles. To this variety belong most cultivated European Red clovers and also some American ones, notably Chilean Red clover and the so-called Orel Red clover introduced from Russia and described by *Brand* (1). The American Red clover is characterized by having stems and petioles covered with spreading hairs.

In this connection it may be pointed out that the name American Red clover is a somewhat misleading one as it may imply that the variety in question is of American origin. This is, however, not the case since, as is pointed out before, Red clover is not indigenous to the American continent. The variety was first described from Austria-Hungary under the name of var. *expansum* and was, according to *Ascherson & Graebner* (1, vol. 6, p. 555), probably introduced into North America from Austria-Hungary. The reason why it is called American Red clover is that it has for a long time been referred to as *T. pratense L.* var. *americanum Harz*.

Biological Varieties.

From a biological point of view, two main groups of varieties may be briefly mentioned, viz.: Early varieties and Late varieties. As the names indicate, the two groups differ from each other in respect to the time required to reach full development, there being several weeks difference in the time of blossoming between

the extreme early varieties and the extreme late varieties. The essential differences between the two groups, however, are in reality not earliness or lateness, but rather mode of growth and development in general.

Early Red Clover (*Trifolium pratense praecox*) is characterized by comparatively little branched stems. The branches of the stem are generally only 2-4 in number and reach the same height as the stem itself. As a result the heads are all borne on about the same level, a fact which makes a flowering field of Early Red clover appear very even Late Red Clover (*Trifolium pratense serotinum*) has the stems more branched. The branches are generally 4-6 in number and do not reach full development at the same time. They do not attain the same height as the main stem and as a result the flowering heads are borne on different levels. The various heads of a typical Late Red clover plant are, therefore, during the blossoming and fruiting periods, representing different stages of development. Indeed, fully mature heads with ripe seed and heads just beginning to blossom may be found on the same plant.

The most important difference between Early and Late Red clover is, however, their behaviour after cutting. The Early Red clover has the faculty of producing a vigorous second growth, for the reason that after cutting it develops a second set of quick-growing shoots. The Late Red clover lacks the faculty of developing more than one set of shoots in a season and as a result it produces a comparatively scant aftermath after cutting. On the other hand, the yield from the first cutting is very much heavier than the yield from the first cutting of the Early Red clover. For this reason the Late Red clover is especially adapted to northern sections where on account of short seasons only one cutting can normally be relied upon, the more so because it is generally hardier and more persistent than the Early Red clover. On account of its inability to yield a heavy second crop after cutting the Late Red clover is often referred to as "single cut clover" in Great Britain, "En-slaets Klover" in Denmark, "einschnittiger Rothklee" in Germany, all of which names indicate that only one good hay crop may be expected in one season.*

Geographical Varieties.

Red clover is very commonly listed by the trade and referred to in experimental work under names which simply signify the source of production of the seed. Thus such names as Chilean, American, French, Italian, Russian, Silesian, Swedish Red clovers, etc., are commonly employed, the result being that the misconception has been gradually created that the various names represent more or less defined varieties. This is, however, not necessarily the case as will be shown in the following. The use of geographical names such as the ones mentioned is, however, of great practical advantage and many valuable results have been secured from experiments with such geographical "varieties". One of the most outstanding results is the finding that seed of red clover produced at home generally compares very favourably, as far as hay producing ability is concerned, with imported seed and often, indeed, is vastly superior. Many years of experiments in for instance Denmark (*Nielsen* 1, p. 184) and Sweden (*Witte* 3, pp. 91-112) are quite conclusive and have clearly brought out the superior value of home-grown seed.

As already intimated, however, the names "American", "Russian", "Silesian", etc. must not be taken to mean that red clover lots so named represent more or less distinct varieties. On the contrary, especially in such European countries in which red clover seed growing has been practised for a long time, a great number of local varietiees have been more or less unconsciously developed through a process of natural selection. Such local varieties

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* It has already been pointed out that earliness and lateness are in reality not the essential characteristics separating the Early from the Late Red clover. In fact, many varieties of Late Red clover come into bloom comparatively early; such varieties might easily be mistaken for Early Red clover were it not for the fact that the branching of the stem and the nature of the aftermath after cutting proclaim them to belong to the late type (cfr. Witte, 2, p. 60). For practical purposes the various types are generally grouped together as Early, Medium Late, and Late Red clovers (cfr. Nielsen 1, p. 178).

may in many cases display quite a conspicuous degree of uniformity in respect to general appearance and growth, colour of flowers and foliage, etc. Thus, *Eriksson* (1, pp. 30-31) describes more or less in detail nine local varieties from Sweden.

In most cases it is next to impossible to express adequately the differences existing between the many local varieties. That great differences exist between them, however, becomes evident when results of comparative tests are studied. *Witte,* who for many years conducted variety tests with red clover, states in this connection that there are grown in Sweden a great number of red clover "varieties" differing from each other in respect to yielding power, growth after cutting, development, and durability (3, p. 103). Under the circumstances, it is evident that different local varieties may be of very different agricultural value, a fact which, indeed, may be of more importance to importers of foreign seed than from what country the seed is imported.

Note. — The second part of this article, dealing with "Individual Variation and Inheritance of Characters" will appear in the December issue.

The Genetic Basis for Improvement in Self-Fertilized Crops

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In the discussion of this subject the writer has a two fold object in view, first, to trace the development of genetic thought as it has affected breeding practice with autogamous plants and, secondly, to call attention to a hitherto unemphasized property of populations of pure lines.

I

To some it would seem superfluous to argue the value of the contributions of genetic science to crop improvement but it is so frequently said that practice has gained nothing by the discovery and elucidation of the principles involved in heredity that an examination of the facts will perhaps serve a useful purpose. It is commonly contended and justly so, that the majority of our most useful plants were brought to their present degree of perfection before man knew of Mendelian inheritance. It is equally true that the empirical means employed succeeded only at the cost of much vain hope and a vast amount of fruitless effort. Success could ensue only when the methods were in harmony with the underlying laws. With all man's persistence and ingenuity progress is but painfully made without clear thinking. And it is here that the revelations of genetic science in late years have come to his aid. A score of fallacies that have infested the minds of animal breeders for centuries have fallen before the convincing logic of controlled experiments, and the modern plant breeder who has not made genetics his best working tool is ill-equipped, indeed. Perhaps no contribution of genetic research has become more widely incorporated in plant breeding projects than the *pure line* concept. It is today the basis of all intelligent efforts to improve self-fertilized crops. Let us inquire into the development of this idea.

Since the first primitive attempts at agriculture were made the best among domestic animals and cultivated plants had been chosen for propagation. Improvement was in many cases, at least, unquestionably evident. Following the widespread acceptance of the Darwinian theory of evolution advanced in 1859, it was believed that by the continual selection of individuals of a certain type, progress would ensue in the direction of selection. Darwin's endorsement of the Lamarckian view that variations of all kinds were inherited seemed to explain in an adequate manner the results that the breeders had obtained. Thirty-eight years after the appearance of the famous "Origin of Species" Sir Francis Galton elaborated the law of ancestral inheritance. Galton it was who introduced the statistical method and applying it to the problem of in-

heritance of human stature, he was enabled to observe that the offspring of parents either taller or shorter than the average of the race tended in a certain degree to retain the parental characteristic. The essential point of Galton's work in this connection is that it was not only in harmony with the selection hypothesis current at that time, but it was also regarded as affording a mathematical measure of the amount of progress that could be made.

In 1883, two years after Darwin's death, Weismann, a German zoologist, brought forward a new theory of heredity. According to the Weismannian concept, variations as regards their transmissability fell into two well-defined categories, first, those which had a basis in the germplasm of the organism and passed through it from generation to generation, and secondly those modifications that were due purely to the environment whose effect was upon the body only and consequently could not be transmitted to the offspring. Weismann, further, advanced the theory that the chromosomes were the essential physical bodies within the germ cells concerned in heredity. Added weight to this view was provided by the researches of Boveri and other cytologists who showed that in certain animal forms the germ cells are laid down at an early stage in the development of the organism and have their origin in a part of the embryo different from that giving rise to the body.

The epoch-making researches of Gregor Mendel brought to light in the year 1900 proved to be the long sought master key to inheritance. The work of the great Augustinian monk will stand for all time as a model of that type of constructive effort which mankind has been too prone to discourage. It is not necessary here to recount Mendel's clear cut experiments with the garden pea, his careful analysis of the breeding facts he obtained and his fitting the theory thereto that we now know as Mendel's Laws of Heredity. In visualizing his results Mendel used an algebraic notation, the hybrids obtained on crossing a plant pure for the dominant character A with one pure for the recessive a, being represented as having the composition Aa. And it should be noted that he made the general mathematical deduction that in any generation n, the ratio of this pair Aa would be $2^n—1$ A: 2 Aa: $2^n—1a$, assuming equal fertility in all the plants and constant self-fertilization throughout. As shall be presently seen this was an important contribution to the solution of the selection problem. The further elucidation of this important question was a direct result of the impetus afforded the study of heredity by Mendel's work.

Johannsen's[1] classical experiments with the common bean led to a discovery of tremendous significance to breeding and gave to us our first real knowledge regarding the genetic composition of self-fertilized species. His results, moreover, explained the conflicting results of those many plant breeders who in the years before had been practising selection in the vain hope that progress could be made thereby, irrespective of the pollination habit of the plant.

The Danish botanist's early results led him to doubt the validity of Galton's law. Selecting seeds of different sizes and of known weights for planting, he harvested and weighed the progeny of each plant separately and observed that instead of the 2/3 inheritance that Galton found in size of seed in sweet pea and in stature of man, the average amount of resemblance to parental types was about ¼. He noted also that the offspring of similar mother beans differed very markedly in size. The frequency distribution of the progeny of parent beans of a given weight proved to be skew, a result contrary to expectation if the material belonged to a single type. With this indication of heterogeneity, Johannsen pursued the problem further. In 1901 he harvested the seeds of 19 plants each of which originated from a single seed chosen from the previous year's crop. Of the 1901 crop 524 seeds were planted representing, respectively, each of the 19 lines. In harvesting the 1902 crop each line and each plant was kept distinct so that the lineage of every single bean weighed was known precisely. By tabulating in juxtaposition the weights of the mother beans and offspring in each of the 19 lines

[1] Johannsen W. Elemente der exakten Erblichkeitslehre. Jena 1909.

it was quite apparent that irrespective of the size of bean chosen for propagation within a given line, the progeny maintained the weight, characteristic of the line to which they belonged. Such variation as did occur was merely fortuitous and selection within a line was consequently without avail in changing the type of the offspring. Continuing the experiment by selecting in successive years large beans on the one hand and small beans on the other within a single line, Johannsen confirmed his contention that these variations were not inherited and that each strain constituted a *pure line* which he defined as "the progeny of a single self-fertilized individual of homogeneous factorial composition."

The composition of plant populations in such self-fertilized or autogamous forms as wheat, oats, barley, beans and peas now became readily apparent. Since Mendel had shown in his original paper that continued self-fertilization resulted in the rapid elimination of heterozygosity, it followed that such species as behaved in this way comprised a number of pure lines and on the isolation of any single plant the odds were overwhelmingly in favor of obtaining a true breeding individual among whose offspring selection would be without effect.

Various authors in later years have elaborated upon the principle involved. Jennings [1a] has shown that in the simplest case i. e. in the cross AA x *aa* giving an F_1 generation of the constitution A*a*, after n generations of self-fertilization the proportion of the different genotypes AA A*a* : *aa* will be

$$\frac{2^n-1}{2^{n+1}} : \frac{1}{2^n} : \frac{2^n-1}{2^{n+1}} \text{ respectively.}$$

Where more than one character pair is involved East and Jones [2] give a convenient formula for calculating the genotypic expectation. If n represents the number of allelomorphic pairs involved the probable number of homozygotes and any particular class of heterozygotes in the rth generation is found by expanding the binomial $1 + (2^r - 1)^n$ the exponents of the first term giving the number of heterozygous, and the exponents of the second term the number of homozygous pairs.

These genetic principles have important applications in crop breeding and in the last twenty years have been a most important factor in the development of plant breeding methods. The Swedish Institute for the Improvement of Field Crops at Svalöf was the first organization of its kind to practise the isolation of single plants in the production of better varieties of wheat, oats, barley, vetches and peas. Nilsson in 1891 was led to adopt the separate culture system through the accidental discovery that only the offspring of single wheat plants were entirely uniform. The researches of Johannsen having demonstrated the biological soundness of genotypic selection and defined its limitations, the isolation of pure lines where improvement in self-fertilized crops was desired came into extensive use at agricultural experiment stations throughout the world. The genotype hypothesis, fundamental as it is in all plant breeding schemes, forms a notable contribution of science to clear thinking and intelligent practice.

II

In the application of the genotype hypothesis to crop improvement schemes, the legitimate question arises if changes may not occasionally take place within pure lines that will so lower their commercial value as to necessitate further selection or a change of seed in order to maintain the original qualities. At least one well known seed growers' association [3] has made provision for remedial measures in case of deterioration or degeneration in some self-fertilized crops. The remainder of this paper will be devoted to a consideration of the biological justification for such precautions with such species as oats, barley, wheat, beans and peas.

As applied to the problem in hand we may consider the terms deterioration or degeneration as designating any *heritable* change occurring in the stock tending to

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1a Jennings, H. S. Numerical Results of Diverse Systems of Breeding. Genetics, 1916, 1 pp. 71.

2 East, E. M. and Jones, D. F. Inbreeding and Outbreeding. Phila., 1919, pp. 90-91.

3 See Report Canadian Seed Growers' Association 15th and 16th years work 1918-1920, page 6.

decrease its commercial value. While other qualities contribute in a measure, it is the capacity to yield that largely determines the worth of the common farm crops whose value per unit is low. Consequently this character receives primary consideration in crop improvement work. Only such degeneration as impairs this capacity will be considered here but it must be borne in mind that changes may take place that lower commercial value that, perhaps, are not reflected in yield. Our present knowledge regarding mutations is too meagre to settle this point, but there is much evidence to show that a change in a single genetic factor may have a manifold effect upon the body tissues of the organism. Thus the mutation "white eye" in Drosophila is accompanied by a marked decrease in both viability and fecundity. That gross morphological characters may be conditioned by a single factor difference is well established and it has been observed that a change in the germplasm may occasion a somatic alteration so slight that it cannot be readily detected. As to the cause and frequency of mutations practically nothing is known since the problem is bound up with the very nature of protoplasm itself. But the gene has proved to be a relatively stable entity and mutations comparatively infrequent. In his pure lines of beans Johannsen has reported but two among thousands of plants. Plant breeders are inclined to regard progressive mutations, at least, of too infrequent occurrence to be of assistance in their operations.[4]

It seems quite probable that retrogressive mutations such as cause a decrease in chlorophyll production for instance, may take place which impair the plant in its normal metabolic processes. It is reasonable to assume also that disease resistance could be similarly affected. In fact, we have no evidence which indicates that any genetic factor concerned in the determination of a plant's ability to yield, and from the nature of the case there must be many, is immune from a degressive change.

Proceeding on the assumption, then, that mutations within pure lines may occasionally occur resulting in the segregation of sub-races of an inferior character, what is the effect on the yield of the population in general in succeeding generations?

The problem may be discussed in general terms as follows: In a pure line A yielding[5] at the rate of r bushels per acre, a single individual appears among $(n+1)$ plants, giving rise to a pure line B which is capable of producing $(r\text{-}s)$ bushels per acre. In this generation, which we may conveniently call the F_1, the ratio of the yield of line A to that of line B is as $nr:(r\text{-}s)$. Assuming complete self-fertilization and equal viability in both lines, a random sample of the mixture on being sown will give rise to a stand in the ratio of nr plants of line A to $(r\text{-}s)$ plants of line B yielding at the rate of r and $(r\text{-}s)$ bus. per acre respectively. Thus the ratio of the yield of line A to line B in the F_2 generation will be as $nr^2:(r\text{-}s)^2$. It is obvious that we have here geometrical series and that in any filial generation p the ratio of yield of A:B is as $n\,r^p:(r\text{-}s)^p$. From this it may be deduced that for each bushel of seed produced by the plants in B in the pth generation there are $n(r/r\text{-}s)^p$ bus. produced by A. We may write the ratio A:B then as $n(r/r\text{-}s)^p:1^p$. Now since p is a variable increasing in magnitude by 1 at each consecutive generation the antecedent in each succeeding ratio will be increased by $(r/r\text{-}s)$ while the corresponding consequent will always be equal to unity. The terms on all cases being positive the rapid diminution of the proportion of individuals comprising line B results.

To illustrate. If within a pure line X capable of yielding at the rate of 50 bus. per acre a single individual arises in a population of 101 plants as the result of a degressive mutation, giving rise to a pure line Y with a yielding capacity of 40 bus. per acre the proportions of the crop harvested resulting from lines X and Y res-

[4] Hayes, H. K. and Garber, R. J. 1919. Breeding Small Grains in Minnesota. Bul. 182 Part I. Univ. of Minn. Agr. Expt. Station.

[5] Environmental influences will, of course, result in fluctuations in yield but the general values assigned may be taken as representing the average yield determined by repeated trials over a period of years.

pectively in the generations 1 to 12 will be as follows:

Generation	Ratio X:Y
1	100.00—1
2	125.00—1
3	156.25—1
4	195.31—1
5	244.14—1
6	305.17—1
7	381.47—1
8	476.84—1
9	596.05—1
10	745.06—1
11	931.32—1
12	1164.15—1

It will be noted in the above table that in 4 generations the proportion of individuals in the lower yielding strain is almost halved and that in the 12th generation so reduced as to become practically negligible. The rapid increase in the higher yielding line X is represented in Fig. 1.

The conclusion may be drawn from the above discussion that in populations consisting of pure lines having different yield values, those strains exhibiting the lower capacities in this respect tend to become automatically eliminated. It might be shown also that the greater the difference in yield the more rapidly will this elimination proceed. Although it has been a matter of common knowledge among agronomists that mixtures of oats and barley, for instance, fail to maintain their original proportions on being grown from seed mixtures taken from successive crops, this property of pure line populations has not been previously emphasized as a self-regulating factor in maintaining the original qualities of a superior strain when degressive mutations take place.

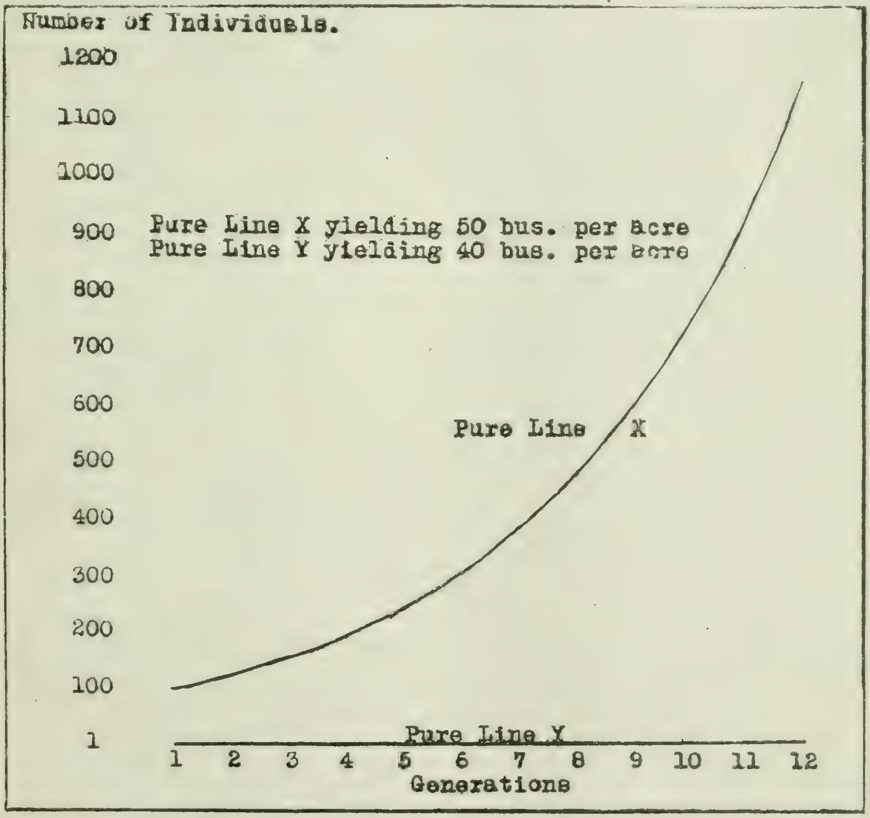

Fig. 1.—Graph showing the number of individuals in Line X per single individual in Line Y in 12 successive generations, the initial proportion of plants being 100 to 1 respectively.

Fertilizers and Canada's Agricultural Future

By H. G. BELL,

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Sometimes a veil of mystery seems to becloud the whole fertility question—especially when a discussion of fertilizers is undertaken. No doubt this tinge of mystery comes partly from the rather inexplicable returns which come from the application of a small amount of fertilizer under most favorable conditions. We feel that too much has been made of the mystery side of the question in times past, and that the best interests of the farm will be served by a closer acquaintance with fertilizers, their composition and best use.

What Fertilizers Are.

Fertilizers are carriers of exactly the same plantfood constituents as are found in the crop, in the soil, and in stock manure, but in more concentrated and available forms. The materials which carry these plantfoods in fertilizers come from various parts of the world, from primary products, from by-products, from waste material. It may serve a good purpose for us to actually catalogue the leading sources of nitrogen, phosphoric avid and potash:

NITROGEN comes from *blood* and *tankage,* waste products of the packing-house industry and both carriers of a considerable percentage of available nitrogen.

This element may come also from *sulphate of ammonia,* a by-product salt of the coking industry. Sulphate of ammonia is proving more and more useful in fertilizers where nitrogen of fairly rapidly available type is necessary. When using sulphate of ammonia, one has to be careful to apply lime in rotation sufficiently often to keep the soil reaction neutral or alkaline, since the ammonium salt tends to leave an acid reaction in the soil. Sulphate of ammonia is proving especially valuable as a nitrogen carrier for orchard crops.

Cyanamid, although a comparatively new product, is being so developed that it can be used successfully in fertilizers as a carrier of nitrogen. The nitrogen in its primary form in cyanamid, is closely connected with calcium and carbon. This rapidly breaks down into an ammonia form which changes in the soil to nitrates which are directly available as plantfood.

These four carriers of nitrogen are all manufactured in Canada. There has been a considerable importation of *nitrate of soda* in times past,—a soluble salt which carries a relatively high percentage of available nitrogen. Where extraordinarily quick action is necessary this salt provides the plantfood in a very available form, but for sandy soils and for crops requiring a continuous supply of nitrogen it is proving more profitable to obtain a considerable amount of the ammonia from more slowly available forms.

PHOSPHORIC ACID may come from any one or more of the following three materials:

First—*Acid Phosphate.* Acid Phosphate is acidulated phosphate rock, generally imported from Southern and Eastern states. There are some deposits of phosphate rock in our own country in the vicinity of Kingston, Ont. and Buckingham, Que. In the manufacture of acid phosphate, the acidulation of the phosphate rock is carried on only to that point where the phosphate of the rock is broken down to its most soluble form, which is the mono-calcic salt. Long-time experiments, chemical studies, prove that the use of acid phosphate does not render the soil acid. Students of chemistry will sometimes question the necessity of acidulating rock when it is a well known fact that as soon as the mono-calcic phosphate mixes with the soil it immediately reverts to less soluble forms, but the whole object of the treatment is to add an available form of phosphoric acid which can distribute quickly and thoroughly through the soil waters. The big advantage is that when it does revert, phosphoric acid is mixed throughout the top areas of the soil, where the plant feeds, with a thoroughness far in excess of any

mixture which can be made by fine grinding and mechanical application of the untreated phosphate rock itself.

The next carrier is *bone*.. This was the original source of phosphoric acid. The success with which bone can be used depends upon the fineness of its grinding. It is a splendid source of phosphoric acid where a continuous supply of this material is desired by the crop.

The third source is *basic slag*. This is a by-product of the steel industry. The phosphoric acid in slag is supposed to be in what is known as the tetracalcic form. Basic slag of high quality is proving of considerable value on meadow and pasture crops. If the slag is of high phosphoric acid content and is carefully applied it is capable of rendering good service.

POTASH comes from salts mined in Central Europe, especially in Alsace, France, and in those sections of Germany closely bordering Alsace. Potash salts as a rule are rapidly water-soluble. The richest in potash are the *muriate* and the *sulphate*.

The fertilizer industry obtains the materials for its various brands or mixtures of plantfood from the foregoing sources. The materials are assembled six to ten months ahead of the time when the material is purchased by the framer. Under careful chemical supervision these materials are combined so as to make mixtures of a definite chemical composition according to standards laid down by the Canadian Fertilizer Act.

Three Things Necessary to the Best Use of Fertilizers.

Even though the industry assembles material as described and handles it in such a way as to prepare fertilizers which will give the farmer greatest value for his money, still there is altogether too large a degree of misuse of fertilizers. This often means a loss to the farmer. Then, too, there is a general lack of appreciation of what this great servant of the farm can do. Three things are necessary:

(a) *Better elementary education in chemistry*. In our present high school courses in chemistry, while the work is covered with thoroughness, yet in far too many cases it is dealt with entirely apart from the life experiences of the student. Its interesting phenomena are in too many cases presented in a purely academic manner, depriving the subject of its intense and lively interest. Indeed it is questionable whether the charm of chemistry has even been grasped by many of the teachers that attempt to instruct in this line.

Before the agriculture of Canada can advance to any great extent this condition must be corrected. Especially where rural boys and girls are attending high school there should be a definite attempt made to relate every phase of chemical study to the problems of the farm. Intelligent study of soil management, of fertility, feeding of animals and control of disease, as well as other phases of farm occupation, depend entirely upon a knowledge of chemical change. All the more reason, then, that students who are preparing to make farming their life work should have an intimate and practical knowledge of this important subject. Indeed we doubt very seriously if chemistry should not be introduced into the studies of the later years of public school—chemistry in its elementary form—so that our boys and girls may form a liking for a subject which is fundamental to the raising of the level of Canadian farming.

(b) *Closer study of published data*. In all civilized countries for the last twenty years there have been accumulated reams of reports of scientific investigations, and records of long-time practical and valuable experiments. Yet how little is known of this material, and how poorly prepared the average institute speaker is to present even the faintest application of chemical data pertaining to the subject it discusses! This is due we believe to an insufficient study in our college courses of the chemical data developed in different parts of the world. At the moment there seems to be a great tendency to develop further study of farm economics. This is well. The subject is certainly in need of wider development, but what is the use of working at the superstructure while neglecting foundation principles?

There is altogether too much tendency to confine information regarding chemical studies in fertility within national bounds. For instance, in not a few cases the writer has heard the criticism that data from England, Massachusetts, Ohio, New York, Australia, may be alright for the sections where

it is developed, but is not applicable to Ontario conditions. Such a criticism is in many instances rank nonsense. It is worse. It is a stumbling block to the advance of farming in Canada. Let it be remembered that, while political questions are local, and while national tendency towards a high standard of patriotism has definite fields of application, scientific knowledge is universal, Knowledge of whatever sort knows no national bounds. It should be so considered, no matter what antipathy may develop toward an organization or nationality, or what is our pride in the findings of our own provincial or national institutions. The scientific advancement of Canadian farming depends absolutely on world facts.

(c) The agricultural press of the country should endeavour to present more interesting chemical data concerning farm problems. It is true that tables of figures are uninteresting if poorly interpreted. Interest is based upon appreciation. With an improved elementary educational system farmers in general would be looking for facts, and would demand of their local press such information as will actually serve to improve their methods.

Farmers' clubs would find it highly advantageous to discuss more of these chemical problems in their meetings, under leaderships which should be capable of explaining and illustrating principles in a clear and understandable manner, by the use of illustrative data. There is absolutely no reason why farm chemistry should be uninteresting. Problems of chemistry are as full of interest as an egg is of meat when actually applied to the problems of farm life.

Canada is sorely in need of a far-reaching system of soil fertility investigations. With our sectional peculiarities of soil, rainfall and range of temperature, we have a whole world of problems as yet unsolved. Excellent work is being done on stock feeding and breeding and improvement of crops of all sorts, but as yet investigations with reference to fertility problems in Canada have almost remained untouched.

By this we do not mean that the work done at American and European institutions need be duplicated, but investigations relating to problems of our own interest should be undertaken with the least possible delay, and principles already established by long-time experiments in other parts of the world should be fully and carefully demonstrated.

Bags of Fallacies.

In Canada's study of her fertility problem, especially in relation to the use of fertilizers there are bags of fallacies thoroughly distributed throughout the Dominion. Let me illustrate seven:

1.—Our soil is inexhaustible.

This view is held by what might be called the transient farmer, the man (a family) who settled in the Maritime provinces or Ontario, moved on to new lands of the same provinces or to the west, and, caught by the enthusiasm of each boom, continued on his westward course over lands of virgin fertility.

In not a few instances successful farms have been conducted on local and infrequent areas of extremely rich soil, upon which the practice of taking off crops without putting back any fertility was attended with a fair amount of success. These advocates of the theory of inexhaustible fertility may point to the fact that Rothamsted has a plot where wheat has been growing continuously for the last ninety years, where still they produce eight to ten bushels of wheat per acre. True it is that nature has provided such a wonderful store-house of soil fertility that it seems impossible to absolutely exhaust the supply, but Canadian farming is not running on the "margin of cultivation". We are now competing with other sections of the world which are producing (not in small and circumscribed localities, but throughout large areas of the farming districts) yields of ordinary farm crops which double and treble those obtained on the average Canadian farm. Hence the necessity of our forgetting the theory of inexhaustible fertility and paying attention to such methods as will economically produce the larger yields.

2. There are still a few farmers left who believe that rotation of crops is all that is necessary to maintain the productiveness of our farm areas. The late Dr. Hopkins very effectively and concisely disposed of this idea when he said that it was just as logical to maintain the farmer's bank account by circulating his cheque book among the members of his family as it is to main-

tain the fertility of the soil by shifting his crops in a system of rotation. The fundamental principle is still true—you cannot continually take from, without adding to.

3. In the older parts of Canada where live stock production predominates, there is not a small number of farmers who believe and teach that nothing should be sold from the farm except in the shape of livestock, and that if livestock are kept to the extent of the ability of the farm to support them, there will be no need of bringing in fertility in the shape of fertilizers.

Now, strange to say, livestock men who put forth this idea are not building up the fertility of the country, much less are they working to their own best interests. Middleton in an article on recent development in German agriculture published by the Board of Agriculture and Fisheries, England, in 1916, concretely illustrated the outcome of such a policy when he compared the operation of a 100 acre farm in Germany with the management of an equal area in England. He showed that, under the German system, the hundred acre farm produced 50 per cent more milk than the English farm and about the same amount of livestock, while the grain produced on the German farm was nearly double that grown on the English farm. 100 acres of tillable land in Germany supported 50 per cent. more people than 100 acres of approximately as good land in England. Now what was the history of the operation of these two farms?

The German farmer placed his soil fertility first. He did not attempt to keep livestock simply to produce manure, nor yet did he attempt to feed to his livestock everything that was grown on the farm. Indeed, his livestock consumed all the waste material on the farm such as straw, cornstalks, sugar-beet pulp and refuse, and the like, and he imported increasing amounts of fertilizer so that his grain yields increased 65 per cent and his potatoes 55 per cent in 10 years. His present attitude toward recovery in productivity of German soils is indicated by the following excerpt from a recent number of the Saturday Evening Post:

"The third problem of Germany's future food supply, the return to intensive agriculture, will be solved by again making farming a business that pays. It is a problem of fertilizers. With sufficient fertilizers the area of land has no fixed relation to its yield. By fertilization Germany in a generation doubled her wheat yield per area unit; and she can do it again. In the early 80's of the last century, when she was importing annually 50,000 tons of Chile nitrates, she produced 17.8 bushels of wheat per acre. When by 1913 her nitrate imports had risen to 747,000 tons, the yield had risen to 33.8 bushels per acre."

Certainly we need more livestock in Canada. Certainly the livestock interests should be paramount in sections where livestock can most profitably be produced. The point is that if Canadian farmers are to prodnce livestock in greater quantity, at less cost per pound, they must have an increased supply of better quality stock feed, at a lower cost of production. Herein is the necessity of increased fertility established. In other words, Ontario, Quebec and Maritime farmers must fertilize the soil to increase its carrying capacity of livestock.

4. There may be certain farmers who have successfully used fertilizers and have obtained such results that they have concluded that fertilizers are all-sufficient. This belief is by no means in the best interests of Canadian farming. Fertilizers have their great and essential place in our system of agriculture, but they must be considered in close relationship to proper soil tillage, an intelligent use of lime, the growth of legumes and seed selection, in order to obtain the greatest improvement of the crops themselves.

5. Certain of our farm leaders are disposed to advocate delay until more is known about fertilizers and their use. This may sound wise caution, but it is not the type of attitude which means progress. In competing with circumstances, such as cited at the beginning of this article, it is obvious that delay is fatal. Farm management studies show that in Ontario a large percentage of the farms, operated as they are, produce an inferior labor income. Better farm organization is undoubtedly one of the great factors in improvement, yet students of the subject have not hesitated to say that better methods of fertility management must be introduced if

the industry is to be improved from its foundation.

We would not wish to be understood as advocating a general and precipitous rush towards the use of fertilizers, but the tremendous service rendered by the intelligent use of fertilizers in France, England, the Netherlands, Eastern and Southern United States, and in many of the older parts of Canada should abundantly justify a much wider use of this great factor in soil fertility than is as yet evident.

6. The cheapness and ultimate dearness of low grade materials is in need of increased attention. It is perfectly natural and right that Canadian farmers should endeavour to obtain fertilizers at as low a cost as possible. Such action is simply putting in practice principles which underlie every other phase of their work. In buying high-grade livestock they do not hesitate to trade for lowest prices, yet they know that if quality is to be obtained, a price commensurate with quality must be paid. Many a farmer who will not hesitate for a moment to buy the best tractor, binder or other farm implement in preference to cheaper material, will go into the market and buy low-priced, low-grade fertilizer.

Farmers beginning the use of fertilizers frequently and unwittingly make this misstep, on the theory that by venturing a little they can prove the merits or demerits of fertilizers. This is not giving fertilizers a fair test. It is just as though the farmer not knowing much about dairy breeds were to go into the open market and pick out average poor cows with a strain of good blood in them, and expect to prove from handling them the merits or demerits of the high-grade purebred stock of the type toward which they tend. Low-grade material in fertilizers is dear at any price, just as it is in everything else.

7. Not a few farmers—frequently of the more monied type are being mystified by claims of what additional bacterial growth can do to their soils. Undoubtedly the bacteria of the soil have a tremendous amount to do with the productivity of it. In fact they are the agents of plantfood preparation in the soil. Their activity seems to depend upon sufficient drainage of the soil, the upkeep of humus, correct chemical reaction, the supply of lime in the soil, and the supply of the essential plantfood constituents on which they work. Certainly, material benefit can come from improving all these conditions for bacterial growth, but to attempt to ultimately improve the soil by bacterial addition alone, is like trying to lift yourself by your shoestrings. Bacteria simply let loose the plantfood of the soil. Again the fallacy of detracting from the soil supply of essential plantfood without putting anything back is illustrated.

The fertility problem of Canada is fundamental. Fertilizers have an essential place in the maintenance of our soil fertility. We have already dealt with the necessity of greater educational activity. This should be supplemented with intelligent and effective control. Not only should fraudulent material be kept off the market, but the inferiority of low-grade material should be shown up by intelligent governmental control, published in terms which are clear and understandable to the average farmers.

Our great opportunity as a nation of farmers is apparent. Whether we shall grasp the opportunity in its entirety will depend not so much upon the the effervescent enthusiasm of the moment, as upon the soundness of the foundations which are laid. With elementary preparation such as we have outlined, supported by demonstration and experimentation making use of already established facts and reaching out to comprehend our local problems, there is no question but that the Canadian farmer, with his great fund of energy and mental capacity, is capable of tackling the problem with an intelligence that will force successful solution.

STUPIDITY STREET.

I saw with open eyes
Singing birds sweet
Sold in the shops
For the people to eat,
Sold in the shops of
Stupidity Street.
I saw in a vision
The worm in the wheat,
And in the shop nothing
For people to eat,
Nothing for sale in
Stupidity Street.

—Ralph Hodgson.

Diseases of the Potato

By B. T. DICKSON, Professor of Botany,

Macdonald College.

(Continued)

(b) *Mosaic and Mosaic Dwarf.*

W. A. Orton first described Mosaic as a disease of potatoes from observations he made in potato fields at Giessen while visiting in Germany, although Quanjer believes that the diesase has been known for a long time in Europe. Orton on his return found the disease to be quite prevalent in Maine in the Green Mountain variety. This was in 1912 and since that time the disease has been found in practically every potato-growing area of the United States and Canada.

The cause of the disease is not yet determined, although it is certainly a systemic disease, and it has been placed here in Group 1 because of the established fact that aphids are agents of inoculation.

While the disease may be regarded as new, as compared with Late Blight for instance, it is highly infectious and has spread with alarming rapidity. In 1919 careful estimates made in Aroostook County, Maine, of 40 fields of Green Mountain and the same number of Bliss Triumph showed an average of 28 per cent of infected hills of Green Mountain and 46 per cent in the case of Bliss Triumph. In some cases the diseased plants amounted to 100 per cent. It is therefore of paramount importance that efforts be continually made to check the spread of this insidious disease. The difficulty involved lies in the fact that the potato tuber, a vegetative part of the plant, is used for seed purposes and the causal principle may be present in the tubers as a result of late infection without there being distinct signs of the disease in the foliage.

Symptoms of the Disease.

The disease may manifest itself in either of two ways according to the variety or according to the locality. The typical symptom from which the name arose is the mottling of the foliage. Lighter green areas occur in the leaves and these lighter green areas may be few or numerous, they may be very small or reach the size of a quarter of an inch, and in shape are usually angular. The leaflets may also be more or less ruffled or wrinkled owing to the modified growth, and where this is the case the wrinkles are likely to obscure the mottling at first sight. The above symptoms are typical for Green Mountain potatoes. It might be added for those readers who have at their disposal a microscope that a thin freehand section through a light green area bordered with the dark green will show, even under the low power, that in the light part the palisade tissue has not been able to develop normally. The cells instead of being from four to six times as long as wide are approximately cubical or distinctly shorter.

The Irish Cobbler, on the other hand, exhibits different characteristics. Here mottling is not usual but instead the leaves of affected plants are extremely wrinkled and dwarfed. The leaflets are smaller, the petioles are reduced and even the haulms are dwarfed. This gives rise to a type known as *Curly Dwarf* in extreme cases. The Rural varieties also show this group of symptoms.

Plate 3.—Plant A is healthy. Plant B is suffering with mosaic. Note at 1 the scars left by fallen leaves and at 2 a leaf which has just dropped.

With regard to locality it is interesting to note that with the same variety the symptoms differ according to whether the variety is planted in a northerly or cooler district, or in a more southerly, warmer place. In the cooler locality mottling is pronounced whereas in the southerly, warmer district mottling is reduced or altogether obscured. That the plants are still diseased, however, is proved by the fact that if tubers from a plant grown under the latter conditions be planted further north mottling is again pronounced.

In addition to the above symptoms it is to be noticed that plants severely affected with mosaic will show this in weaker stem development and in a generally unthrifty condition.

Effect on the Plant.

One effect of the disease has already been mentioned, namely the modified growth of the palisade cells in light green areas. Other cells are affected to a less noticeable extent but the general effect is that the tissues which should be manufacturing a maximum amount of starch are not able to do so and further a proportion of that manufactured is undoubtedly used by the causal principle. This is postulating that the causal principle is a parasite. Hence the amount of food available for tuber formation is reduced according to the severity of the disease and the duration of it in the particular plants. The tubers are therefore reduced in size or in number, or both. In the case of late infection there is not likely to be any noticeable difference in the tubers. Murphy has estimated that severely diseased plants yield only 57.8 per cent of a crop as compared with healthy plants of the same variety under the same cultural conditions.

Infection.

Gussow has shown that by grafting the disease may be readily transmitted and Folsom et. al. have obtained similar results in Maine. The writer in unpublished work has found aphids to be fertile sources of infection, and Folsom et al. have carried on extensive experiments in Maine proving clearly that plant lice (*Myzus persicae* Sulz. and *Macrosiphum solanifolii* Ashmead) are carriers of the disease from plant to plant. The writer has found that aphids are also most important in the transmission of clover mosaic and it is probable that they play a part in most mosaic diseases.

Other potato pests, such as the Colorado potato beetle and the flea beetle, are not found to be carriers of the disease.

Experiments also indicate that the seed-cutting knife is not important in transmitting the disease. The same applies to contact in the field between healthy and diseased plants. Soil has not been found to transmit the disease from one season to the next, but it may be possible that volunteer plants arising from diseased tubers left in the soil will give rise to centres of infection the following season.

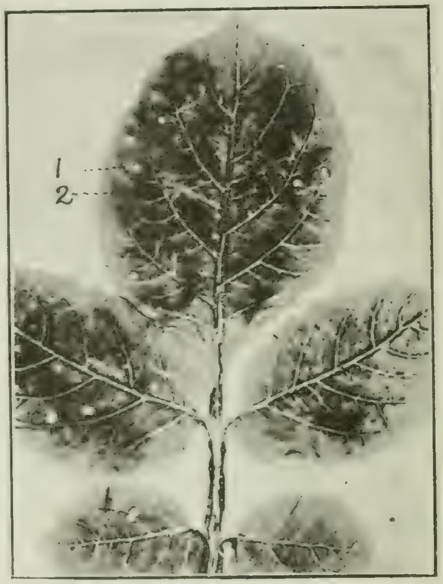


Plate 4.—A leaf of potato showing mosaic mottling. Note at 1 a flea-beetle hole and at 2 a typical light green area.

Varietal Susceptibility.

Little is yet known of this phase of the question and work on it is difficult because of the carrying over of diseased tubers which came from apparently healthy plants. It is known, however, that on the whole the Irish Cobbler variety is less susceptible to the disease while Green Mountain is particularly susceptible.

Control.

Three points in control are emphasized. If the grower prefers to use his own seed the seed plot should be isolated from other

potato patches in order to reduce the possibility of infection by means of aphids. It follows that the seed tubers used should be healthy as far as it is possible to ascertain this fact. If diseased plants are observed they should be rogued at once and if aphids are seen on the diseased plants when rogued a careful inspection should be made of the plants immediately surrounding. Any upon which aphids are found should also be removed. Finally, since aphids are the prime carriers of the infective principle, it is necessary to control plant lice. To accomplish this add ¾ of a pint of "Black Leaf 40" to every 50 gallons of Bordeaux mixture and spray to cover both the upper and under sides of the leaves.

Before leaving the subject of mosaic, mention should be made of a peculiar condition found in severely diseased plants by Gussow and also by the present writer. In the leaves small, angular areas suddenly become brownish and necrotic. In the petioles brown streaks appear just below the epidermis and later similar lesions develop in the stem. Soon after the lesions appear the petiole collapses and the leaf withers, hanging by a mere thread. It then falls and as the whole plant is rapidly affected a very characteristic appearance is given. This is shown in Plate 3 plant B. It cannot be stated for certain that this is a type of severe mosaic, but the writer has not observed similar conditions in other than mosaic-diseased plants of the Green Mountain variety.

(c) *Potato Leaf-roll.*

The disease known as "*Leaf-roll*" is, like mosaic, comparatively new and in many respects it resembles mosaic. It is infectious, is transmitted by plant lice, it is systemic, and is controlled in the same way.

Symptoms of the disease.

The name suggests the outstanding symptom but care must be exercised in differentiating the rolling of the leaves in this disease from rolling in wilt diseases and in cases of either excessive moisture or continued drought. In true leaf-roll the leaflets are distinctly rigid and not in the least wilted. They are uprolled so that the two margins tend to come together forming a trough-like structure. They are lighter green than normal leaves and in severe cases of the disease they may be yellowish, reddish or purplish. The plants are dwarfed, having shorter petioles and haulms than normal and the whole plant has a typical aspect owing to the angle of development of the petioles. Instead of being rather spreading as in a healthy plant the leaves and branches tend to assume an angle of approximately 45 degrees fom the main stem. The stolons bearing tubers are considerably shortened and the tubers are smaller, fewer, and are conspicuously harder than tubers from healthy plants. This hardness of the tubers is

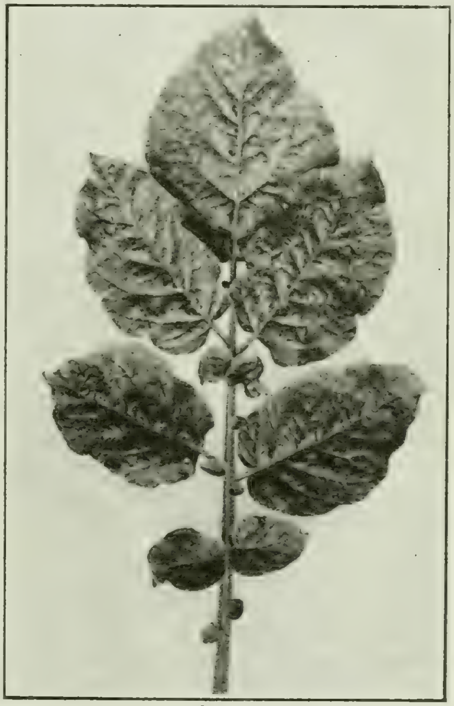


Plate 5.—A leaf showing the dwarf, curled, dark green symptoms of mosaic. There are no apparent light green patches.

maintained even for considerable periods in storage.

The rolling usually appears in the lower leaves first but a late infection may affect only the leaves last developed.

Effect on the Plant.

As with mosaic the leaves of potatoes suffering from leaf-roll do not function properly. The cause of the disease lives in the plant juices and in this case it especially affects that part of the vascular

tissues known as the phloem. In the phloem it gives rise to a necrosis or death of the tissue. Since it is in the phloem that most of the conduction of elaborated food takes place, those parts awaiting supplies of food for their development will receive only a much reduced amount. This is the case with the tubers and the stolons bearing the tubers. Hence those tubers which do develop are small and are borne on short underground stems. Moreover the infective principle passes down the parts of the phloem not killed and reaches the vascular tissues of the developing tuber. In it, therefore, there may also be phloem-necrosis. When such a tuber is cut across, or when it is pared to expose the vascular tissues, these are seen to be browned. The general term "*net-necrosis*" is used to indicate such an appearance, but it must be recollected that net-necrosis may be caused by other conditions than those in leaf-roll. Moreover the tubers from a plant with leaf-roll do not necessarily develop net-necrosis, for they may not be affected soon enough, nor sufficiently severely, to cause necrosis in the vascular tissues. A further effect on the plant is exhibited in the next generation for tubers from diseased plants, and especially those with net-necrosis, frequently develop very weak, spindling sprouts.

The yield from leaf-roll plants is materially reduced, in many cases being nothing at all.

Infection.

The tubers transmit the disease as in the case of mosaic, but an additional fact must be mentioned, namely, that in the progeny of plants with leaf-roll there is a much more rapid depreciation in yield and accentuation of the disease than is the case with mosaic.

Tests conducted in Maine show that aphids again are the only insects of importance in transmitting leaf-roll. The seed-cutting knife is not a factor in the spread of the disease.

Varietal susceptibility:

Red varieties are usually more susceptible than white varieties. Garnet Chili, Davies Warrior, Irish Cobbler, Early Puritan, Early Six Weeks, Dakota Red and McIntyre develop the disease more severely than Carman, Green Mountain, and Empire State. The last named at times appears to be free and at others is severely affected, due in all probability to lack of inoculation by aphids.

Control

The same points mentioned for the control of mosaic apply to the control of leaf-roll.

SPREAD OF THE EUROPEAN CORN BORER.

The investigational work in connection with the European Corn Borer outbreak has led to the discovery of a considerably increased number of host plants of this pest which now amount to approximately forty, including asters, dahlias, peas, beans, celery, etc. On August 24, the Hon. S. F. Tolmie visited the outbreak and was greatly impressed with the seriousness of the pest. On account of the unanticipated spread of the European Corn Borer, an increase was made in the number of scouting crews and the work re-organized. Up to August 27, 53 townships had been scouted, 36 of which were found infested, and 17 uninfested. As 36 townships were found infested in 1920, this brings the total up to 72. In an endeavour to maintain the quarantine, fall fairs are being closely watched, as well as the main highways leading out of the infested area. Many shipments of flowers and vegetables consigned to points in the United States have also been inspected. Supplements Nos. 1 and 2 to quarantine No. 2 (domestic) were signed on August 26 and September 6 respectively. These supplements quarantine townships found infested by the corn borer this season. Mr. H. G. Crawford of Ottawa, and Mr. J. G. Spencer of Guelph have prepared a Crop Protection Leaflet dealing with the control of the Corn Borer, copies of which may be obtained from the Publications Branch, Dep. of Agriculture, Ottawa.

MAKING THE PRAIRIES HOMELIKE

About five million trees per year are sent out free by the Dominion Government Forest Nursery Station at Indian Head, Saskatchewan, to farmers to plant shelter-belts about their farms and buildings. The farmers pay the express charges on the trees and agree to cultivate the ground before and after setting out the plantation.

The Agricultural Representative System in Ontario and Manitoba

Synopsis of address by N. C. McKAY, Assistant Superintendent, Extension Service, Dept. of Agriculture, Winnipeg.

ONTARIO

The Agricultural Representative system originated in Ontario, and was developed by two great agricultural leaders, the late C. C. James, and Dr. G. C. Creelman, ex-president of the O. A. C. The first appointments were made in 1905 and the system has grown until now fifty representatives are employed in as many counties, and many of these have a permanent assistant.

At first the representative was a member of the High School and gave agricultural instruction during the school term. This has however been abandoned and now there is no connection. The County provides $500.00 annually and this is expended by the Representative, with the approval of the Director of Agricultural Representatives. The Department of Agriculture provides all the other funds required for the office. This amounts to approximately $5,000 per year.

Activities: (A) Educational.

- School Fairs.
- Courses in Agriculture, 4 weeks.
- Meetings, and 2 day courses.
- Club work.
- Demonstrations and Experiments.

School Fairs: Practically every child in Ontario is now permitted to take part in School Fair activities. Many fields of grain now being grown have originated from choice seed supplied a child through a School Fair.

4 weeks Courses: Held during January and February. Boys and young men attend (average age, 18-20 years), and at conclusion of course organize into "Junior Farmer Improvement Association", carry out programme during year, such as meetings, athletic meets, debates, tours, stock judging, etc.

Judging work featured: At the Canadian National Exhibition, Toronto, in 1921, 285 contestants took part in the Judging competition. Judging teams each year for Guelph and Ottawa Winter Fairs are selected from these Associations. These trained young farmers have greatly influenced stock raising and many of the best Fall Fair judges are now coming from these boys.

Club Work: Boys and girls older than school age compete in this: raise vegetables, pigs, calves, sheep, poultry, etc.

Demonstrations and Experimental Work: Experimental work largely dropped: farm demonstrations now practised. These, such as "Source of Seed" demonstration in potatoes: variety tests in corn, etc., are proving very popular.

Poultry breeding stations: Each county has from one to five poultry breeding stations. All eggs for school fair purposes are obtained from these—other farmers and poultry breeders in the County also purchase large numbers of eggs from these each year. The farmers own the females, the males are supplied by the O. A. C., and the owners of the flocks are under contract.

Activities—(B) Commercial Lines: Educational lines are followed up by commercial activities and representatives are responsible for a great many of the co-operative organizations now in operation. Assistance is given in collecting and marketing live stock, wool, potatoes, fruit, poultry, and many other lines. The representative, while not assuming the active management of the Association is frequently the directing figure behind the organization.

The representative co-operates with all agricultural organizations and now in some Counties an "Advisory Agricultural Council" meets at regular intervals to assist and direct him in his work.

MANITOBA

The system first started in 1915. At present there are six offices open and several applications are in for new ones.

Manitoba, being largely a grain-growing district, does not offer quite as many lines for work. A working unit is more difficult to obtain, as one to three municipalities have to be grouped together.

Municipalities make grants and government pays $1,800 per year towards salary; the balance comes locally.

Farmers are behind the movement where offices have been opened and requests are coming from Municipalities alongside of these in which representatives are now employed.

In each district an Advisory Agricultural Council is selected comprising representatives of the Municipal Council, Local U. F. M., U .F. W. M., Agricultural Societies, Trustees Associations, etc. These meet regularly and discuss problems and map out programme with the representative.

WILD GRASSES OF MANITOBA.

At a local branch meeting of the C.S.T.A., held in Winnipeg on September 29th a very interesting talg on the above subject was given by Prof. V. W. Jackson of the Manitoba Agricultural College. Of the sixty species of wild grasses, forty-three pressed specimens were shown to those at the meeting.

Professor Jackson stated that the tonnage of wild grasses in Manitoba far exceeds that of the cultivated varieties, and pointed out that the cultivated grasses occupied less than five percent of the cultivated areas. Many shipping stations, such as Ashern, ship over 300 car loads of wild grasses in a season. The most abundant varieties are Blue-stem, Scotch Grass and Wild Timothy.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL SECRETARY

With the present issue, the financial difficulties of the Society, which were greatly increased by taking over the ownership of *Scientific Agriculture*, appear to have been overcome. During the past three months every effort has been made to increase the revenue from subscriptions and advertising and to keep the operating expenses at as low a figure as possible. It has been difficult to adhere to the advertising policy decided upon by the Executive, but no departure from that policy has yet had to be made. No announcement has been accepted which could not be endorsed by the Society.

In setting a financial objective towards which to aim, it was felt that the revenue from the magazine should be sufficient to cover all costs of publication, and that the revenue from membership fees in the Society should be applied only to operating expenses apart from the magazine. A reduction in the amount of the annual fee was considered advisable when this condition was reached, and further surplus would be used in whatever manner might be considered advisable by the Dominion Executive Committee.

At the present time it is not possible to make any definite announcement, owing to the fact that all renewal membership fees have not yet been paid. The response from advertisers has been very gratifying and even better results are to be expected after the close of the calendar year.

So far as a lowering of the membership fee is concerned, this much can be said—if all renewal fees are paid by the present members, a substantial reduction in the annual fee would be possible on June 1st, 1922. It is not likely that any reduction will be made in the initial membership fee, as it is felt that only the present members should benefit by any reduction that may be possible; new members would continue to pay the $10.00 fee that has been paid by the six hundred present members.

At the time of writing an energetic campaign for new members is being undertaken, as well as a campaign for the payment of renewal fees. These two campaigns will be concurrent with the establishment of the Bureau of Records. The questionnaire for the Bureau is now being mailed to all members, and it is hoped that the Bureau will be open and active by

January 1st. Before the close of the present year a complete revised list of members in good standing will be prepared and sent to governments, colleges, societies, firms and other agencies throughout the world which might be expected to co-operate in giving publicity to the Society and in making the operations of the Bureau successful.

A period of very grave uncertainty was passed between July 1 and September 30, but the enthusiasm and support of the members and branches has brought the Society to the beginning of what appears to be a very successful and progressive era.

MACDONALD COLLEGE BRANCH.

An excellent and most enthusiastic Convention was held by this local at Macdonald College on October 20th and 21st. Quite a number of members residing at points distant from the College were in attendance, as well as the entire staff of the College. Mr. H. S. Arkell, Dominion Live Stock Commissioner, President J. B. Reynolds of the Ontario Agricultural College, Mr. J. N. Ponton, Editor of Le Bulletin des Agriculteurs, and others gave special addresses.

At the opening luncheon the members were welcomed by Principal Harrison. The first day of the Convention was devoted mainly to a discussion on the question of extension work in Quebec, the various departmental activities at Macdonald College and field problems in various parts of the province. In all these topics, leaders in the discussions had been selected, and much information, of very wide interest, was brought out.

On the second day, the members visited the various departments of the College, where practical demonstrations were held. The meeting ended with a luncheon on October 21st, when an address was given by President Reynolds on "The Agricultural College and its Constituency."

It is impossible to publish in this issue any detailed report, but an effort is being made to secure and compile the more important facts which were discussed. On such questions as insecticides, pure seed, field crop competitions, school fairs, and a number of others, the material presented in open discussion would have been of great interest to many agricultural workers in other parts of the Dominion.

About forty members attended the meetings.

MANITOBA BRANCH.

The first meeting of this local was held in Winnipeg on September 29th. Two addresses were given, one by Vincent W. Jackson on "Wild Grasses of Manitoba" and the other by N. C. MacKay on "District Representative Work in Ontario and Manitoba". These two addresses are published in brief form in this issue.

It is planned to hold a business meeting early in November.

EASTERN ONTARIO BRANCH.

At an executive meeting held on October 11th, it was decided to commence the winter programme early in November and to hold monthly meetings until March, 1922.

NOTES.

R. C. Treherne (O.A.C. '09) has taken up his new duties as Chief of the Division of Field Crop and Garden Insects, Entomological Branch, Ottawa. When last seen on October 11th, he was very busy becoming established. He expects to visit British Columbia in January.

Dr. Alfred Savage (Macdonald '11) has resigned his position of Veterinarian at Macdonald College to take a similar position at the Manitoba Agricultural College, Winnipeg. It is understood that his new duties will also include those of Provincial Veterinarian under The Provincial Department of Agriculture, and some extension work for the Health of Animals Branch at Ottawa.

J. B. Harrington (Saskatchewan '20) is taking advanced work in agronomy at the Minnesota Agricultural College. His address is 2089 Carter Avenue, St. Paul, Minn.

James Waddell (Saskatchewan '20) also on the staff of the University of Saskatchewan, is taking post graduate work in animal husbandry at the State College, Ames, Iowa.

J. E. Bergey (O.A.C. '14) formerly assistant in Poultry Husbandry at the Manitoba Agricultural College is farming at Beamsville, Ont.

W. R. Leslie (O.A.C. '16) has been appointed Superintendent of the Experimental Station at Morden, Manitoba. He was formerly at the Industrial Farm, Fort William. At Morden he replaces E. M. Straight (Macdonald '11) who has been transferred to the Experimental Station at Sydney, B.C. as Superintendent.

J. A. Ste. Marie (Macdonald '16) has been appointed Superintendent of the Experimental Farm at Ste. Anne de la Pocatière, P.Q.

Dr. G. R. Bisby (Minnesota '18) Plant Pathologist at the Manitoba Agricultural College, is spending one year with the British Imperial Bureau of Plant Pathology, Kew Gardens, London.

J. Sydney Dash, (Macdonald '13) who for some years has been Director of the Agricultural Station at Guadeloupe, B.W.I., has returned to Canada, for a change of climate. He has taken up work in the Tobacco Division, Central Experimental Farm, Ottawa.

F. C. Nunnick (O.A.C. '10) has succeeded the late W. A. Lang as Chief of the Extension and Publicity Division of the Experimental Farms Branch, at Ottawa.

F. W. Bates (McGill 1907, 1909) of the Department of Education at Regina, attended the McGill Centennial Re-Union in Montreal.

A. K. Olive (Manitoba '14), formerly with the Soldiers' Settlement Board, is now manager of the Canadian Department of the Hail Audit and Statistical Bureau, Regina. His address is 815 McCallum—Hill Building.

Wilfrid Sadler (Macdonald '15), Professor of Dairying at the University of British Columbia, was married on September 15th to Miss Olive Maclean of Patricia Bay, B.C.

At the McGill Re-Union Banquet in the Windsor Hotel, Montreal, on the evening of October 13th, the following graduates of Macdonald College were included in what the press called a "convivial gathering": F. H. Grindley, '11, R. Summerby '11, C. Sweet '11, A. R. Ness '12, L. C. Raymond '12, E. M. DuPorte '13, C. H. Hodge '14, J. E. McOuat '15, C. Lyster '16, A. E. Hyndman '16, J. H. McOuat '16, G. E. Arnold '18, R. J. M. Reid '18, E. C. Hatch '20, W. A. Maw '20, T. G. Major '21, P. M. Daly '21 and J. K. Richardson '21.

CHANGES IN ADDRESSES.

Alex. J. Rioux, Macamic, Abitibi County, P.Q.

J. B. Harrington, 2089 Carter Ave., St. Paul, Minn.

Gustave Prince, Roberval, Lac St-Jean, P. Q.

Norman F. Wilson, 609 Hope Chambers, Ottawa, Ont.

J. C. Moynan, Experimental Farm, Ottawa, Ont.

J. E. Bergey, Beamsville, Ont.

W. H. Smith, Chatham, Ont.

A. Savage, Manitoba Agricultural College, Winnipeg, Man.

James Waddell, Iowa State College, Ames, Iowa.

A. K. Olive, 815 McCallum Hill Bldg., Regina, Sask.

APPLICATIONS FOR MEMBERSHIP.

The following applications for membership have been accepted:

Thos. S. Acheson, C.P.R., Winnipeg, Man. (Associate Member).

J. G. Coulson, (Queens, 1921, M.A.) Macdonald College, P.Q.

R. Gagnon, (Laval, 1916, B.S.A.) Riviere du Loup, P.Q.

L. A. Gibson, Dairy Commissioner, Winnipeg, Man.

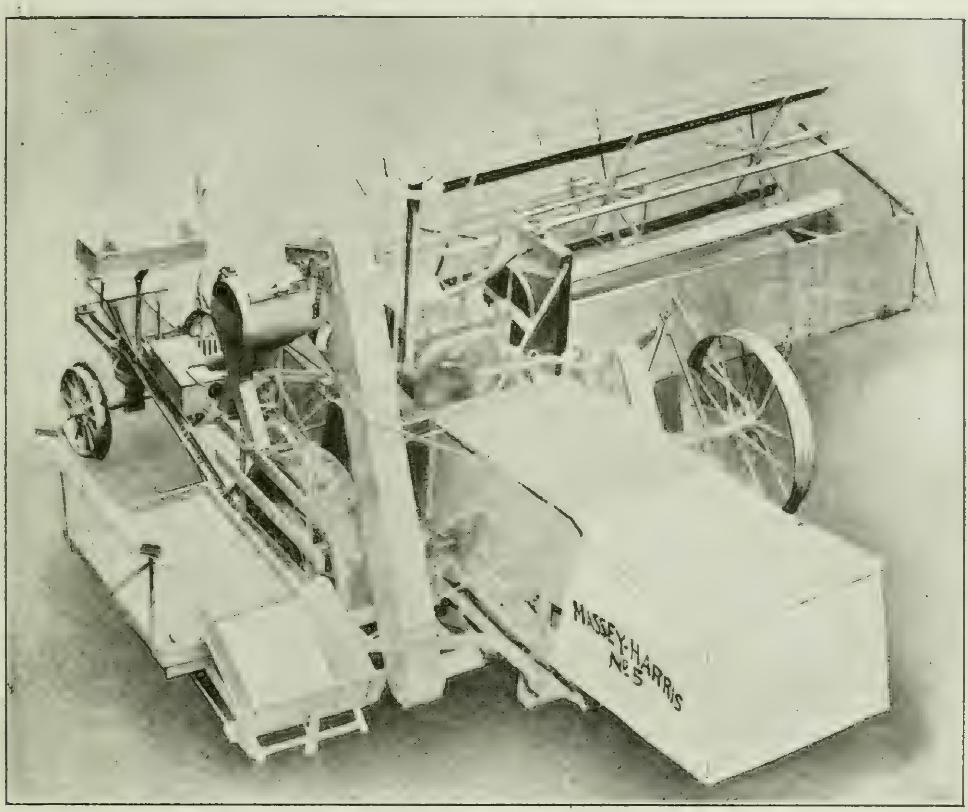
Phillip Illsley (Toronto, 1916, B.S.A.) Wolfville, N.S.

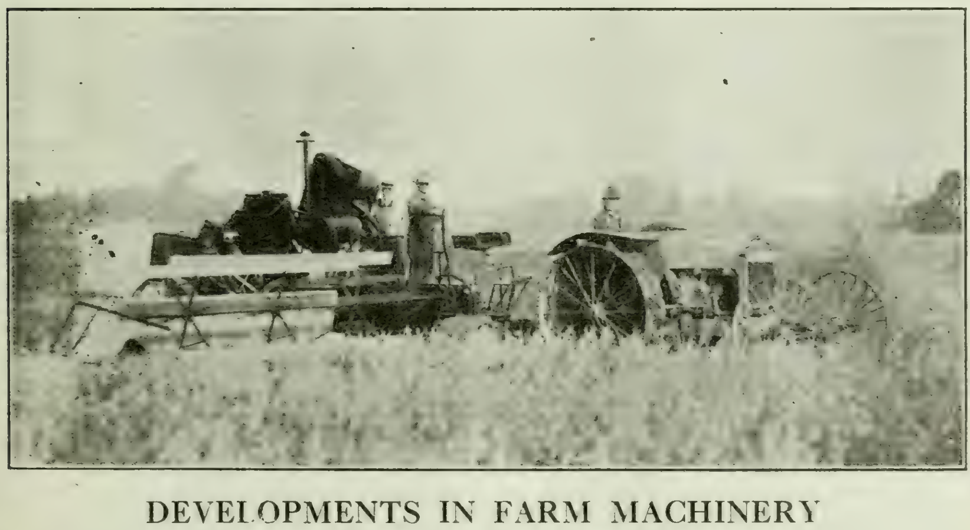
W. N. Jones, (McGill, 1919, B.S.A.) University of B. C. Vancouver, B.C.

Georges Maheux, (Laval, 1911, 1914, B. A., I.F.) Dept. of Agriculture, Quebec.

L. Reynauld (Laval, 1920, B.S.A.) Ste-Anne de la Pocatiere, P.Q.

The present membership of the Society is 598.





DEVELOPMENTS IN FARM MACHINERY

The development of new machinery is something of vital interest to everyone engaged in agriculture. The machine shown in the accompanying illustrations is a Reaper-Thresher manufactured by the Massey-Harris Company. The machine has been used in South Africa, Australia and the United States, as well as in Europe, and was recently demonstrated at the Canadian National Exhibition. The machine is not being recommended by the manufacturers for use in Canada, but was demonstrated for educational purposes to many who might not otherwise have an opportunity of seeing the machine in operation.

L'Importance Economique de l'Enseignement Agricole

Par H. M. Nagant,
Professeur à l'Institut Agricole d'Oka.

Dans l'économie mondiale on pourrait comparer l'agriculture au tronc de notre bel orme canadien, qui, surgissant majestueusement du sol où il est supporté par les racines puissantes qui le nourrissent, se divise en un éventail de branches vigoureuses étalant au soleil son dôme de verdure.

Et de fait toutes les industries, à quelques exceptions près, ne sont que les auxiliaires, les supports de l'agriculture, comme les racines pour le tronc de l'arbre, ou ses dérivés, comme les nombreuses branches qui constituent sa couronne.

Ainsi, par exemple, il suffit de considérer quelques instants la grande industrie métallurgique pour se rendre compte que les millions de tonnes d'acier, qu'elle produit chaque année, servent surtout à encercler le globe de rubans métalliques mille fois entrecroisés, formant le réseau immense sur lequel circulent d'innombrables trains chargés de céréales, de fourages, de bétail, de matières textiles, etc.

Arrivés dans les ports d'expédition, tous ces produits s'engouffrent dans les cales de gigantesques steamers, sont transportés de l'autre côté de l'océan pour se répandre, par un nouveau réseau de voies ferrées, sur un autre continent. Les immenses entreprises de transport ouvrent le chemin à l'agriculture dans les pays nouveaux et permettent de lui donner un développement intense dans les régions déjà peuplées. En retour de ces services, la culture leur fournit le trafic et assure leur prospérité.

Les produits du sol, dès qu'ils sont recueillis, appellent de multiples transformations. Ici, il suffit de songer aux industries de l'alimentation, telles que les meuneries, abattoirs, fabriques de conserves, sucreries, amidonneries, brasseries, distilleries, etc.; aux industries du vêtement et de la toilete telles que les filatures, les tissages, les tanneries, les cordonneries, les savonneries, etc. Il est clair comme le jour que l'importance et l'extension de toutes ces industries, ainsi que des entreprises commerciales dont le rôle est de distribuer les produits finis et préparés, au consommateur, sont en fonction directe de la production agricole.

Ce sont là peut-être des vérités de M. de la Palice; mais nous avons cru devoir les rappeler, parce que l'on n'en tient, généralement, pas assez compte dans l'organisation économique. Et, en parlant ainsi nous n'avons pas seulement en vue le gros public, mais aussi nombre de personnages dirigeants et de gouvernements. C'est ce que faisait remarquer le baron de Levetzow, délégué officiel de l'Allemagne au 10ème Congrès international d'agriculture, tenu à Gand en 1913:

"Quand, dans un pays, disait-il, l'industrie se développe aussi considérablement qu'en Allemagne, il est naturel que le public et même le gouvernement pensent que le développement de l'industrie améliorerait l'avenir du pays. On prend des mesures, on fait des lois pour faciliter le développement. Mais ce qui se présente chez nous et ailleurs, c'est qu'on oublie que l'agriculture est la source même de la force de l'Etat et aussi de l'industrie (industries proprement dites)."

Il y a 20 ans, le comte von Caprivi (alors Chancelier de l'Empire) émit l'idée que le bien public dépendait des exportations des produits de l'idustrie et que l'agriculture était chose négligeable. Depuis lors, l'organisation du "Bund der Landwirte" (Association des cultivateurs) a eu un succès tel, que, maintenant, les politiciens raisonnables et le gouvernement ont compris qu'on ne peut négliger l'agriculture sans ruiner l'économie nationale, le pays et la race même. Pour démontrer l'importance de l'agriculture, comparée à l'industrie, nous avons dressé le tableau affiché à la séance.

Il était nécessaire d'éclairer le public sur l'importance de la valeur des produits agricoles et on ne pouvait mieux faire pour cela que de les comparer avec les valeurs dont tout le monde reconnaît l'importance, les valeurs des produits de l'industrie."

Si l'Allemagne est un pays fortement industriel, sa petite voisine, l'active et industrieuse Belgique, dont elle convoitait depuis longtemps les richesses, l'est encore

plus et l'industrie des mines, de la métallurgie, les manufactures de tous genres y occupent, proportion gardée, une part plus grande encore dans l'économie générale du pays. C'est encore au congrès d'agriculture de Gand, déjà mentionné, que M. le député Maenhaut disait que l'industrie agricole, en Belgique, égalait en importance toutes les autres industries réunies. Aussi les statistiques publiées par l'"Institut International d'Agriculture de Rome," nous apprennent qu'en 1912 la valeur totale de la production agricole, pour la Belgique, atteignait le chiffre énorme de trois milliards 200 millions de francs. Si le facteur d'importance économique, que représente l'agriculture, est déjà si prépondérant dans un pays, industriel par excellence, tel que la Belgique, qui exporte à l'étranger 75 pour cent de ses produits manufacturiers, combien ne l'est-il pas davantage pour les nations moins industrielles et celles qui sont à dominante franchement agricoles, telles que le Canada, où les industries proprement dites ne sont qu'à l'état naissant et ne suppléent qu'aux besoins intérieurs.

De ces quelques considérations il est facile à déduire que tout progrès, réalisé dans les pratiques agricoles d'un pays, doit avoir une répercussion énorme sur son économie générale.

Or, l'agriculture, depuis qu'elle est sortie de la routine des siècles passés, est devenue une véritable science, science complexe, puisque ses principes et ses procédés sont empruntés à plusieurs groupes de sciences distinctes. Il est moins permis que jamais, à un homme sensé, d'en parler comme le faisaient encore il n'y a pas bien longtemps beaucoup de gens instruits, tel, il y a une trentaine d'années seulement, un premier ministre belge, M. Malou, lorsqu'il disait que la science agricole se résumait en une bêche et un râteau, avec de bons bras pour s'en servir.

Les principales sciences qui ont envahi le domaine de l'agriculture relèvent surtout des connaissances chimico-biologiques, mécaniques et économiques.

On sait l'évolution surprenante qu'ont subie les sciences du premier groupe, depuis un siècle environ; or, l'agriculture scientifique est intimement liée au progrès de la chimie, qu'elle a suivie pas à pas dans ses conquêtes. Déjà l'illustre Lavoisier, en même temps qu'il faisait les découvertes fondamentales de cette science, jetait une nouvelle lumière sur les mystères de la vie végétale. Mais il fallut attendre jusqu'en 1840, l'apparition du livre du savant allemand, Justus von Liebig, intitulé: "Chimie organique appliquée à l'agriculture et à la physiologie," pour révolutionner toutes les notions admises, jusqu'alors, concernant la physiologie des plantes. (André: Traité de Chimie Agricole.)

Liebig découvrit, avec le mode de nutrition minérale des végétaux, la relation qui existe entre le rendement des récoltes et la composition chimique des sols. Cette relation fut exprimée dans sa célèbre *loi du minimum.* Il enseigna comment on pouvait améliorer cette composition des sols, rétablir leur fertilité par l'apport de substances minérales dont il existait, dans certains endroits du globe, de grands gisements inutilisés jusqu'alors. L'emploi de ces matières minérales, désignées généralement sous le nom d'engrais chimiques, vint révolutionner la culture, en amenant la solution du problème de la restitution et en instaurant les méthodes de culture intensive, qui acquirent une importance primordiale, en Europe surtout.

Depuis l'époque de Liebig, la technique agricole a marché de progrès en progrès; une pléiade de savants agronomes, parmi lesquels il convient de citer, Lawes et Gilbert, en Angleterre; Boussingault, Georges Ville, Muntz et Girard, en France; Schultz, Wolff et bien d'autres en Allemagne, appliquèrent les progrès de la chimie à l'étude de la composition du sol, des végétaux, des animaux, établirent et vulgarisèrent les principes établis par Liebig, dans les recherches et des expériences restées célèbres. Grâce à ces travaux, les pratiques routinières et empiriques de l'exploitation agricole font place à un travail de précision, raisonné; le sol est cultivé d'une manière beaucoup plus intensive; la connaissance de la composition et de la valeur des matières alimentaires pour le bétail, permet un rationnement mieux proportionné et plus économique.

Depuis une trentaine d'années, nous sommes entrés dans une nouvelle ère de progrès, résultant des fameuses découvertes de Pasteur, le créateur de la microbiologie. Une foule de phénomènes, restés inexpliqués par la chimie inanimée ont été

élucidés lorsqu'il fut démontré qu'ils étaient le résultat de l'activité de ces infiniment petits, dont on ne soupçonnait pas le rôle auparavant. Dans les laboratoires et les stations de recherches de tous les pays, de savants disciples de Pasteur se mirent en devoir d'étudier, par de patientes observations, les synthèses étonnantes et les analyses compliquées qu'opèrent ces myriades d'extraordinaires petits chimistes, dans le mystère profond du sol arable, laboratoire ténébreux, aux recoins innombrables, où chacune de leurs catégories travaille dans des conditions particulières: s'attaquant à certaines substances, dans un sens déterminé, pour les passer à d'autres groupes de petits sorciers qui continuent ou achèvent les transformations: tout comme dans les ateliers de mécanique les plus compliqués, où la division du travail est poussée à l'extrême, le lingot d'acier brut passe par cent mains et cent machines différentes, pour apparaître enfin à l'état d'objet fini.

Parmi les faits capitaux mis en lumière, dans l'étude de la microbiologie, appliquée à l'agriculture, il faut mentionner la découverte de la conversion, dans le sol, des principes azotés, en nitrates; le mode spécial de nutrition de certaines plantes, aux dépens de l'azote atmosphérique, grâce à l'intermédiaire du fameux "*bacillus radicicola*," qui envahit leurs racines et leur passe le précieux élément que constitue l'azote, que lui seul est capable de fixer à l'état de combinaison, en retour d'autres matières nutritives fournies par la plante nourricière.

Outre cet exemple curieux d'association d'intérêts vitaux entre individus, que nous offre le règne végétal, on a découvert encore des catégories de microbes menant une vie indépendante, dans le sol, où ils puisent leur substance et leur énergie transformatrice, à la matière organique en décomposition, et possédant aussi le don remarquable de capter l'azote de l'atmosphère ambiante pour le convertir en combinaisons azotées servant d'aliment aux racines des végétaux supérieurs.

Il y a tout lieu de supposer qu'on n'en est encore rendu qu'au début des découvertes de l'activité microbienne dans la chimie du sol, et que l'avenir nous réserve bien des trouvailles qui permettront d'influencer en connaissance de cause et avec une précision scientifique la fertilité de la terre arable.

Nous ne ferons que mentionner ici l'importance qu'a encore la microbiologie dans la lutte contre les maladies qui affectent les plantes cultivées, dans les industries dérivant directement de l'agriculture, telles que la fromagerie, la beurrerie, les industries de fermentation, etc.

Il suffit d'étudier un peu les questions de drainage, d'irrigation, de travail du sol; de jeter un regard dans les catalogues de machines et de moteurs de tous genres, qui trouvent leur application en agriculture ou dans les industries immédiatement connexes, pour se convaincre que les sciences physiques et mécaniques occupent une place non négligeable dans la technique de l'agriculture moderne.

Il est superflu de démontrer que la botanique, l'anatomie et la zootechnie sont des sciences essentiellement dévouées à l'agriculture où elles trouvent une application pratique dans le choix et la sélection des races, dans la création et l'amélioration des variétés tant végétales qu'animales, dans la lutte contre les maladies, etc.

Enfin la diffusion des sciences économiques et sociales, dans l'immense classe des gens qui vivent directement de la terre, importe peut-être autant que celle de toutes les autres réunies, comme facteur de prospérité. Une principe élémentaire, dans toute industrie, c'est qu'il ne suffit pas de produire, mais qu'il faut produire le plus économiquement possible et écouler les produits avec le maximum de bénéfices. Or, à notre époque, la situation des cultivateurs, surtout lorsqu'on les considère à l'état de groupements, a d'autant plus d'analogie avec celle des industriels et des commerçants ordinaires, que la multiplicité des moyens de transport et la rapidité avec laquelle peuvent se faire les livraisons permettent l'expédition au loin des produits du sol. Le cultivateur doit donc aussi recevoir une éducation commerciale, ce qui lui manque peut-être le plus. Un bon système de comptabilité lui est absolument indispensable pour pouvoir distinguer les branches de son exploitation qui lui donnent des bénéfices de celles qui le mettent en perte. Les questions de marchés, d'expédition, de classement des produits sont encore extrêmement importantes. Mais, pris isolément, un cultivateur ne peut pas faire grand'chose, dans le domaine pure-

ment commercial. Il obtient difficilement, et seulement dans des conditions onéreuses, le crédit dont il a besoin pour l'achat de ses machines, pour l'exécution d'améliorations foncières. Les intermédiaires trop nombreux, qu'il ne peut éviter, lui enlèvent la plus grande partie du bénéfice représentant la différence entre son prix de revient et celui payé par le consommateur. C'est pourquoi il s'agit de l'initier à tous les modes d'association, qui seuls peuvent lui fournir la puissance nécessaire pour jouir d'un crédit raisonnable, pour acheter en gros ses matières premières, pour s'imposer sur le marché, pour atteindre le consommateur en évitant tous les détours inutiles qui mangent le fruit de son travail.

Il est inutile d'insister sur les perspectives immenses qu'offre à l'étude et à l'enseignement la question des associations d'ordre économique, en agriculture; sujet auquel l' "Institut International d'Agriculture de Rome" consacre un Bulletin mensuel spécial, ne s'occupant que de l'analyse sommaire de tous les travaux qui se publient sur cette matière, des applications nouvelles qui se font dans les divers pays du monde.

Une puissante organisation de l'enseignement agricole constitue donc un facteur de progrès économique immense pour le pays qui la possède; aussi on peut dire que le budget que les gouvernements consacrent à son entretien et à son développement est une dépense retrouvée au centuple dans la prospérité croissante de la nation. En fouillant un peu dans les statistiques agricoles des divers pays de l'Europe Occidentale, il ne serait pas difficile de prouver surabondamment, au moyen de chiffres, l'exactitude de cette assertion. Signalons, par exemple, qu'il résulte des tableaux dressés par l'Institut International d'Agriculture de Rome, que, depuis trente ans, la production du blé en France s'est accrue de 16 millions d'hectolitres (près de 50 millions de minots), bien que les surfaces emblavées y soient restées à peu près invariables. Ce bénéfice provient donc de l'élévation du rendement par unité de surface, c'est-à-dire du progrès continu, amené par l'enseignement généralisé des méthodes de culture intensive. Citons aussi ces paroles de M. Méline, au congrès de Gand, déjà mentionné: "Quant au gouvernement belge, tout en restant dans son rôle, il a été pour beaucoup dans l'évolution agricole qui a permis à la Belgique de traverser la crise agricole sans en souffrir sérieusement: il ne s'est pas contenté de prodiguer à toutes les oeuvres d'organisation et d'enseignement agricoles, de larges subventions; c'est lui qui a résolument orienté l'enseignement des jeunes générations vers les choses de la terre et créé ainsi, aux populations rurales, une mentalité nouvelle." Il affirmait par ces paroles que la merveilleuse prospérité dont jouissait ce petit pays, avant d'être jeté dans la ruine et la désolation, par la lâche agression allemande, découlait, pour une grande part, de la bonne technique agricole, dont la vulgarisation avait triomphé de la crise générale de l'agriculture, qui affectait l'Europe, d'une façon si aiguë, vers 1880.

Les statistiques suivantes sont bien propres à donner une idée de l'influence qu'a eue l'enseignement agricole sur l'augmentation de la production en Belgique, entre les années 1846 et 1909. Nous réduisons en minots, à l'acre, les chiffres donnés en kilogrammes par hectare (tirés du rapport de la Commission américaine, qui fit une enquête sur l'économie rurale, dans les différents pays d'Europe, il y a quatre ans). Elles nous apprennent que les rendements à l'acre furent en moyenne pour tout le pays:

Récoltes	1846	1880	1909
	minots	minots	minots
Blé	21.1	22.5	37.05
Seigle	20.93	22.36	35.9
Avoine	36.4	41.85	65
	lbs.	lbs.	lbs.
Betteraves . . .	25520	28410	48190

Un simple examen de ces chiffres est bien suggestif. Si nous considérons, par exemple, le blé, nous voyons tout de suite que la progression durant les 34 années qui séparent 1846 de 1880, période encore adonnée à la routine, n'a été que de 1.4 minot à l'acre; tandis qu'en 1909, vingt-neuf années plus tard, le rendement moyen s'élevait de 14.55 minots. Pour cette céréale, la progression dans le rendement, par unité de surface, a donc été de plus de dix fois aussi forte pour les 29 dernières années que durant les 34 qui précédèrent. Les chiffres de production sont à l'avenant pour les autres récoltes. Et, maintenant, remarquons tout de suite que l'Institut Agronomique de l'Université de Louvain fut

fondé en 1880; que l'institution du corps des Agronomes de l'Etat (agronomes de districts) remonte à l'année 1885. Ceci nous explique assez la corrélation.

Mentionnons encore, dans un même ordre d'idées, les statistiques du rendement moyen, par unité de surface, en Allemagne, qui démontrent l'importance économique du facteur enseignement agricole (extraites du bulletin d'avril 1914, de l'Institut International d'Agriculture de Rome).

Récoltes	1890 minots	1912 minots à l'acre
Blé	23.93	33.18
Seigle	20.64	29.31
Avoine	37.6	50.3
Pommes de terre. .	154.3	220.4
	lbs.	lbs.
Foin	2920	4050

A cela on peut encore ajouter, sans faire une affirmation téméraire, que la force de résistance de l'empire germanique, dans la dernière guerre, où il se trouve à faire face au monde entier, fut basée avant tout sur la parfaite exploitation de ses ressources agricoles. Ici aussi les prédictions d'avant-guerre ne se sont pas réalisées. L'idée généralement admise était que l'Allemagne, avec son territoire, en grande partie peu fertile, habité par une nombreuse population industrielle, ne pourrait pas subvenir longtemps à ses besoins alimentaires et que le blocus exercé par l'Angleterre et ses alliés devrait fatalement l'acculer à la famine, dès la fin de la première année de guerre. Mais on ne tenait pas compte de l'avancement des sciences agricoles dans ce pays. Méthodique en ceci, comme dans tous les autres domaines du reste, il y avait des années que l'Allemagne faisait pratiquer par ses agriculteurs les principes de la science agricole, établis ou développés dans ses universités et ses laboratoires, éprouvés dans ses stations d'expériences et vulgarisés par de multiples démonstrations. Ainsi, d'une part, elle avait augmenté considérablement la productivité de ses bonnes régions agricoles, tandis que les immenses plaines sablonneuses de l'Allemagne du Nord, au lieu d'être restées le paysage de bruyères coupées de marais tourbeux qu'on se plaisait à imaginer, furent converties en champs fertiles, grâce à des méthodes soignées de drainage et à l'emploi sur une grande échelle des sels de potasse, extraits de ses mains et des engrais phosphatés, sous-produits de son immense industrie métallurgique, et à d'autres amendements.

L'organisation générale d'un enseignement agricole réellement efficace, dont on puisse attendre le maximum d'effet utile pour l'avancement de toute l'agriculture d'un pays est plus difficile à réaliser que celle de la technique du commerce ou des industries proprement dites. Car, dans ce dernier cas, le nombre d'exploitants est relativement petit, leurs entreprises, souvent considérables, reçoivent directement l'impulsion de leurs dirigeants. La formation d'une élite d'experts en finances, et d'ingénieurs suffira à faire bénéficier les maisons de commerce et les usines qu'ils auront à diriger, des connaissances acquises, des perfectionnements à apporter dans les procédés. L'agriculture, tout en étant en elle-même la plus grande industrie du monde, est celle qui a le moins le cohésion. Son enseignement, comme la sève et le sang dans une plante ou un animal, doit pouvoir atteindre chacun des innombrables chefs d'exploitations éparpillés par tout le pays comme les cellules dans l'organisme. Il doit donc partir d'un organe central, comme le sang du coeur, puis, par une suite de modifications et d'adaptations, en cours de route, être diffusé à travers les masses profondes des exploitants du sol, par tout le réseau des canalisations secondaires, qui en mettra les principes à la portée de tous.

Cet organe central c'est l'enseignement agricole supérieur, source du progrès agricole d'un pays.

De sa force, de son organisation et des moyens dont il dispose, dépendent aussi l'impulsion et les bonnes méthodes de l'enseignement vulgarisé et pratiques qui en découle tout comme la fécondité de l'Egypte est sous la dépendance de la crue du Nil, qui lui distribue ses eaux bienfaisantes par mille canaux d'irrigation.

Or, on rencontre encore des personnes qui ignorent ou méconnaissent la nécessité des hautes études en agriculture, sous prétexte que l'important ce n'est pas de faire de nos jeunes gens des théoriciens qui désapprennent le travail manuel ou n'acquièrent pas l'habilité d'un ouvrier capable, mais bien des praticiens qui retourneront à la terre. Parler ainsi revient au même que nier l'utilité d'une école polytechnique

pour la formation des ingénieurs et de ne préconiser que des écoles techniques fournissant des contremaîtres et des ouvriers habiles, comme si nos grandes usines et nos ateliers pouvaient exister et fonctionner, dans l'ordre technique et économique, sans un personnel d'ingénieurs compétents.

En agriculture aussi, il est essentiel de créer une classe dirigeante, car nous avons déjà exposé, au début de cet article le nombre et l'étendue des sciences auxquelles elle fait appel, ce qui nous dispense de démontrer que l'industrie fondamentale de l'humanité a besoin d'une âme, d'un cerveau, formés d'un personnel de théoriciens très compétents, pour en assurer le fonctionnement méthodique et le progrès.

La tâche dévolue à ce personnel est de coordonner la marche des différentes branches de l'économie agricole, de leur faire connaître les découvertes que les sciences apportent chaque jour à la solution des divers problèmes intéressant l'agriculture, d'organiser des stations d'expériences ou de démonstrations, de diriger et de surveiller l'enseignement agricole secondaire et élémentaire, dont la diffusion s'impose.

Même en n'étant pas un instrument direct de production, un agronome théoricien peut donc être une cause de rendement et un facteur économique autrement considérable que plusieurs praticiens, auxquels il suffira d'ailleurs, en général, d'acquérir l'habileté et les connaissances indispensables dans une institution d'enseignement secondaire ou élémentaire.

Ceci me paraît aussi juste que d'affirmer que le Canada doit le succès et la bonne exploitation de son merveilleux chemin de fer du Pacifique aux financiers perspicaces et aux savants ingénieurs qui en ont conçu et exécuté le projet, plutôt qu'aux employés subalternes et aux contremaîtres qui accomplissent les besognes routinières.

L'enseignement agricole supérieur une fois bien établi, le problème, aussi délicat qu'important, de l'enseignement secondaire et pratique trouve sa solution naturelle, grâce à la force du premier, dont il est le complément nécessaire pour diffuser l'application des principes, sous une forme assimilable, à la masse des exploitants du sol. Les diplômés des universités agricoles, classés de pair avec les avocats, les médecins, les ingénieurs, non seulement jouiront du prestige et de l'influence nécessaire pour promouvoir les intérêts de l'agriculture dans leur juste mesure et d'une façon éclairée, mais, sous leur impulsion et leur direction, se mettra en mouvement tout le rouage destiné à vulgariser les connaissances agricoles dans tout l'enseignement général.

Maintenant, on pourrait demander de citer, comme exemple, des pays où la question de l'enseignement agricole reçoit toute la considération et tout l'appui qu'il mérite, en égard à son importance comme facteur économique. Eh bien! il n'y a pas au monde un gouvernement qui dans les subsides affectés à l'enseignement technique en général fasse à l'enseignement agricole la part que celui-ci est en droit de réclamer. C'est ce qu'affirme M. le député Meanhaut, dans un discours prononcé au Congrès international de Gand, exposant la situation à cet égard en Belgique, qui cependant est l'un des pays ouù l'enseignement agricole a été le plus poussé:

"A la suite d'une enquête préliminaire, disait-il, MM. de Vuyst, Raymakers et Rysiger, ont démontré qu'il y a lieu de se rendre compte davantage de l'importance relative des diverses branches de l'économie des nations. L'industrie agricole est en Belgique aussi importante que toutes les autres réunies; cependant, le budget de l'enseignement agricole ne dépasse pas un quarantième de celui de l'enseignement général, tandis que le budget des écoles professionnelles dépendant du ministère de l'industrie est encore dix fois plus élevé..."

Il est juste de faire remarquer cependant qu'en Amérique, il se fait un effort considérable, depuis quelques années, pour établir un meilleur équilibre entre les diverses classes de l'enseignement technique. Les collèges d'agriculture des divers états de l'Union et leurs stations expérimentales deviennent des modèles du genre, comme perfectionnement des installations, richesses d'aménagement de leurs laboratoires et collections. De l'aveu d'auteurs européens, ils dépassent déjà ce que l'on avait de mieux en Europe, et en Allemagne notamment. Les provinces du Dominion sont aussi entrées dans cette voie; l'Ontario possède, depuis assez longtemps déjà, le célèbre collège de Guelph qui, actuellement, jouit d'un budget annuel d'un quart de million de dollars environ.

On sait qu'un bon nombre de millionnaires anglo-saxons, par le désir de perpétuer leur mémoire, par patriotisme, par un

sentiment de reconnaissance envers le pays où ils ont édifié leur fortune, ont consacré d'énormes sommes à la fondation et à la dotation d'universités ou d'écoles d'enseignement supérieur. On connaît également les anciennes fondations des universités anglaises, les largesses faites dans les dernières années aux universités des Etats-Unis, dont un grand nombre doivent leur prospérité à de généreux millionnaires. Ceux-ci ne sont pas restés en arrière non plus lorsqu'il s'est agi d'enseignement agricole supérieur et nous n'avons même pas à sortir de la province de Québec pour en trouver un exemple patent. Aussi, après avoir essayé de démontrer l'importance économique d'un enseignement agricole aussi parfait que possible, nous voulons terminer ces quelques considérations en affirmant que le développement de cet enseignement devrait intéresser, au plus haut degré, les Canadiens-français.

Ce que tout véritable patriote a le plus à coeur c'est la conservation et le respect de sa langue. Or une langue ne peut conserver son intégrité et ses droits, qu'à la condition d'avoir, dans toutes les professions, des dirigeants, des hommes de prestige et d'influence pour la manier et l'imposer.

De toutes les professions, l'agriculture est, sans contredit, la principale du Canada français. C'est pourquoi on peut se demander s'il est oeuvre patriotique plus féconde méritant mieux laide morale et matérielle de tout Canadien-français, influent ou favorisé de la fortune, que la mise au niveau de perfectionnement voulu de son enseignement agricole supérieur, qui permettra aux habitants de la province de Québec d'atteindre les sommets de la science agricole par l'intermédiaire de leur langue maternelle.

Autrement, ne faut-il pas craindre que les mieux doués, désireux de se perfectionner, ne se sentent attirés par des institutions étrangères, pourvues des laboratoires, des collections, du matériel d'expérimentation, qui aujourd'hui deviennent un facteur toujours plus nécessaire à l'étude théorique et pratique de l'agriculture.

Et si, alors, ils entrent dans la vie publique de leur pays, avec une formation qui n'est pas la leur, un vocabulaire technique anglifié, ils éprouveront de la difficulté à se servir du français pour faire bénéficier des connaissances qu'ils auront acquises leurs compatriotes et de là il n'y aura pas loin au mépris de la langue maternelle.

Matière à Reflexion

Par Gustave Toupin,
Professeur à l'Institut agricole d'Oka.

En 1918, au plus fort de la guerre,—on s'en souvient—c'était notre population humaine qui était menacée d'un maigre menu; en 1921, c'est notre population animale qui est condamnée à la suite de la dernière récolte, à l'abstinence et, pour un fort pourcentage à la mort. La plupart de nos animaux se sont mal hivernés et un bon nombre seront abattus si les cultivateurs ne réussissent pas à se procurer, à bon compte, les fourrages et surtout les concentrés nécessaires. Conséquences: les vaches seront mal préparées pour la production laitière de l'été prochain, ce qui diminuera d'autant la rétribution du fermier en 1922. De plus nos effectifs de bestiaux vont être considérablement réduits, ce qui ne peutître que fort déplorable pour le pays. Telle est la situation.

Qu'une ou des entreprises coopératives ou autres s'organisent pour fournir aux fermiers les fourrages et les concentrés dont ils ont besoin; c'est très bien. Mais ce n'est pas tout ce qu'il y a à faire pour solutionner le problème de l'heure présente.

En effet, on peut prévoir tout de suite que ces institutions ne sauraient vendre ces marchandises à des prix bien inférieurs aux prix des marchés. Quand le foin vaudra $30.00 la tonne, à Montréal, et le son, de $25 à $30 à Fort William ou dans l'Ouest, nous ne voyons pas quelle maison quelle institution pourrait vendre ces mêmes marchandises à des prix inférieurs à ces derniers. En dépit donc de tous les louables efforts que l'on pourrait faire, pour mettre sur le marché de la mangeaille pour nos animaux, les prix seront encore

assez élevés, même si nos maisons de commerce étaient toute prises d'un bel esprit de désintéressement — pour que la question ne trouve pas sa solution complète dans le fait de la présence sur le marché de certaines disponibilités.

Il y a plus à faire. Il faut prêcher et pratiquer — et plus que jamais — l'économie dans le rationnement du bétail, c'est-à-dire l'alimentation rationnelle basée sur l'un ou l'autre des standards ou tables d'alimentation que nous ont légués les laboratoires de l'Allemagne, de la France, de l'Angleterre et des Etats-Unis. Cultivateurs, propagandistes agricoles, professeurs agronomes et publicistes, devront se donner la main pour mener à bonne fin cette campagne importante. Entendons-nous pour l'achat des engrais; ajustons dans la ration des animaux les pailles, les foins, l'ensilage, le grain, de manière à nous rapprocher le plus possible du standard, et conséquemment, nourrir nos bêtes économiquement. Entreprendre ce travail, c'est épargner à la classe agricole des milliers de dollars.

Nous sommes absolument convaincus que tout fermier sérieux qui garde des vaches en vue de la production du lait, pourrait pendant l'hiver préparer son bétail à une plus haute production laitière et soigner plus économiquement s'il rationnait ses animaux d'après les standards ou tables d'alimentation.—Par standard, nous entendons la quantité de matière sèche contenant la protéine et les principes nutritifs; et cela dans des proportions requises, que tout animal doit recevoir, selon son âge et sa classe, ou pour s'entretenir en bonne condition ou pour donner un maximum de production. Ainsi, par exemple, une vache de 1000 livres, pour son entretien seulement, doit recevoir de 15 à 21 livres de matières sèches par jour, contenant de 0.6 à 0.8 de livre de protéine digestible, avec 8 à 10 unités nutritives. C'est le standard d'alimentation pour une vache de 1000 livres. D'un autre côté une vache de 900 livres, donnant 25 livres de lait par jour, dosant 5 pour cent de gras, devra recevoir de 23 à 28 livres de matières sèches contenant 2.13 livres à 2.45 livres de protéine digestible, avec 17 à 18 unités nutritives. C'est le standard pour cette vache en question.

Combien de paille, de foin et de grain ou autres aliments faut-il prendre pour rester d'accord avec le standard? C'est ce qu'il faudrait déterminer en tenant compte le plus possible des mille et une conditions dans lesquelles se trouvent la masse des cultivateurs. Et pour comprendre l'importance économique de la question, jetons un coup d'oeil sur les deux types de rations suivantes pour une vache de 1000 livres, à l'entretien.

	Mat. Sèche	Prot. Dig.	U.N.	Coût
Paille, 15 lbs... ..	13.27	.15	6.84	.06
Foin mêlé, 10 lbs...	8.72	.43	5.13	.15
	21.99	.58	11.97	.21
Paille, 15 lbs.	13.27	.15	6.84	.06
Foin, 5 lbs.	4.36	.21	2.56	0.75
Un engrais, 3 lbs.	2.69	.45	2.10	0.43
	20.32	.81	11.50	.18

De ces deux rations, c'est la première qui est le plus souvent servie; la meilleure et la plus économique, cependant c'est la deuxième où le foin a été réduit de 50 pour cent et où l'engrais a été servi dans la proportion de trois livres par jour ce qui donne une différence de trois sous par jour en moins pour le coût de la seconde ration. Si l'on applique cette différence de trois sous par jour et par tête de bétail, il est intéressant de constater qu'un cultivateur, ayant un troupeau de 10 vaches épargne 30 cents par jour, $9.00 par mois, $50 à $60 durant l'hiver.

Ces chiffres sont assez éloquents il nous semble, pour démontrer toute l'importance qu'il y aurait — surtout en ces temps difficiles sur la ferme — à faire connaître, enseigner, et propager le rationnement économique du bétail d'après les tables d'alimentation, d'après les standards établis.

A L'ASSEMBLEE DE QUEBEC

Il a été résolu:

Que les membres de la Société des agronomes canadiens de Québec se réunissent à des intervalles rapprochés, par groupe de deux ou trois, pour étudier les conditions agricoles locales et transmettre le résultat de ces enquêtes au secrétaire de leur section respective pour être étudiées en assemblée et publiées dans la revue.

Que la Société des Agronomes canadiens a appris avec un souverain regret la mort de l'un de ses membres, M. M. Bélanger, et présente à la famille éprouvée ses plus sincères sympathies.

:: EDITORIAL ::

It is gratifying to note that the importance of Farm Management in the curricula of our agricultural colleges is receiving some recognition. In a recent issue of a western farm paper attention was directed to the comparative uselessness, to the would-be farmer, of a training in entomology, botany, agronomy and other branches of agricultural science, unless these courses are supplemented by a course in Farm Management. It was suggested that in every agricultural college there should be a special department equipped with qualified experts in the teaching of this subject.

There is no doubt that the agricultural colleges will soon give proper recognition, when arranging their courses, to a branch of agriculture as important as Farm Management. The delay in introducing a special course is probably due to two reasons: first, the difficulty of obtaining competent instructors, and second, the equally difficult task of applying the course to all divisions of agriculture. It is not so much a question of introducing the course as it is of so planning it that the specialist in horticulture, or in animal husbandry or in agronomy, will derive the maximum benefit. Rather than introduce a distinct course in Farm Management, for all students, might it not be possible to obtain better results — especially in certain aspects of the subject — by having the instructors in horticulture, animal husbandry agronomy and other subjects, include, in these courses, the application of the principles of farm management to their particular branch of agriculture? It would be difficult, if not impossible, to secure instructors who could be considered experts in all aspects of a subject so broad in its application — that must be apparent to anyone who gives the matter proper consideration.

No one will deny the importance, to the agricultural student, of a knowledge of the business of farming — especially, to the student who intends to return to practical farming. It is to be hoped that every agricultural college will include the subject of Farm Management in its courses in a manner that will best accomplish the end sought — the application of business principles to the science and practice of agriculture.

It is not very many years since Rural Engineering took its place as a distinct subject in an agricultural course and even today comparatively little investigational work is being undertaken in this subject. But almost every agricultural college instructs its students in Rural Engineering because, on the modern farm, a knowledge of machinery, irrigation, mechanical power, drainage, cold storage, etc. is vital. It was found that ordinary engineering principles could not always be applied to agriculture and that a special study of special problems was necessary. From this beginning rapid but fairly recent advances have been made and today Rural Engineering is not only taught to agricultural students but is recognised as a scientific subject, and in the field of research—if we give the word a broad interpretation—is already making some contributions.* Comparatively recently the American Society of Agricultural Engineers came into existence and will give progress in this subject still further impetus.

The progress made towards increased hog production in Canada as well as towards the improvement of quality, as a result of the conference of producers, packers and government officials held at Ottawa early in November is most encouraging. In spite of the different interests which were represented, and the conflicting opinions which might well have been expected at such a gathering, the decisions reached met with practically unanimous approval. If the proposals

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* An outline of the development and growing importance of rural engineering is published in the August (1921) issue of the Experiment Station Record, issued by the Department of Agriculture at Washington.

made are put into effect definite and desirable results will be accomplished.

Optional grading will come into effect on May 1st next at stock yards and abbatoirs; select bacon hogs will be given a premium of ten per cent; a qualified inspector will study the requirements of the British market; representatives of the various agencies concerned — packers, producers and the Dominion Government — will form an advisory committee; and a clearly defined classification of grades will be adopted.

The grading of agricultural products has been one of the most important factors in the agricultural development of Canada, during comparatively recent years. Still further application of the principle of grading is essential to future progress. At the present time grading is used in connection with the marketing of wheat, wool, eggs, fruits, potatoes, cereals for seed purposes, flax and flax seeds, fruits and potatoes. Next May hogs will be added to the list. The grading of dairy products may be anticipated with some degree of certainty.

The introduction of grading regulations must always be preceded by a very careful study of the constituency and the classes which will be affected. That feature was given particular emphasis by Dr. Grisdale in a recent address at Ottawa, when he traced the agricultural development of Canada through its various stages. The drastic application of laws, without a survey of the constituencies which will be influenced by those laws, will always antogonize certain groups. But if the co-operation of those groups is first sought, and the results to be expected are placed clearly before them in perspective, the danger of antagonism is largely overcome. Co-operation within a single group is not sufficient. The co-operation of all classes — producers, distributors and consumers — must be obtained so far as possible.

The development of markets is vital to Canadian agricultural progress. This is a day of competition between exporting countries. Quality of product will do more to facilitate market extension and market control than any other single factor. Grading will ensure quality. The logical conclusion to be drawn, then, is that if Canada is to hold her place in world markets, if she is going to produce steady supply and high quality, grading is not merely desirable but absolutely necessary. The same argument applies to every finished agricultural product.

NEW FRENCH EDITOR.

Owing to pressure of other duties, Prof. Létourneau has found it necessary to resign as Editor of the French section of *Scientific Agriculture*. Professor Létourneau has held this position since the magazine was first established in January last and has given splendid service.

At a meeting of the French members of the Canadian Society of Technical Agriculturists, held in Quebec last month, Mr. Aimé Gagnon of the Agricultural Institute at Oka was appointed to this position and assumes his duties with this issue.

DISEASES OF THE POTATO.

Prof. B. T. Dickson has found it impossible to prepare his article on the above subject for this issue. The series will therefore be resumed in the January number.

MILLIONS OF TREES FOR THE PRAIRIES.

The Dominion Government has always been aware of the necessity for encouraging tree culture on the prairies, but it was not until 1901 that a really definite and practical scheme for assisting settlers in this work was put into operation. It was in that year that the first distribution of trees was made under the co-operative scheme of the Forestry Branch of the Interior Department. From a small beginning the distribution of trees from the nurseries at Indian Head and Sutherland has grown until it now averages about five million seedlings and cuttings each season, half of which are planted in Saskatchewan, and the balance in Alberta and Manitoba. As a consequence of this distribution, we now find in all parts of these provinces examples of excellent farm shelter-belts.—Norman M. Ross, Dominion Forest Nursery Station, Indian Head, Sask.

The Dominant Mendelian Characters in Barley Breeding

By J. G. CARL FRASER,
Cerealist, Experimental Farm, Ottawa.

The idea of this article is to present the results of some of the workers in barley breeding, and to tabulate for ready reference the dominant Mendelian characters of barley, in so far as they have been determined. While the dominant characters may be generally known, this article may sum them up, help shed more light on the subject and put them in tabular form. The material for this article has been obtained from published articles from various writers on both sides of the Atlantic (such as R. H. Biffin, Rimpau and others in Europe), from various United States bulletins and from our own work here, at Ottawa.

In the following findings the deductions of the various workers wil be set forth and where any uncertainty or contradictions occur, both sides of the questions will be put down.

Black colour in palea dominant over white.

The fact that the black colour of the palea was dominant over white has been known for some considerable time and had been noted in pre-Mendelian times, instances being cited by Rimpau, in which the hybrid from a black and white cross gave a *black* and *white*; and *white*. Tschermak more recently investigated the question and found that *black* and *white* forms appeared in the ratio 3 to 1 in the F_2. The same results were obtained by Biffin where he crossed the following black and white varieties:

H. Japanicum x Steudelii
H. Vulgare x Steudelii
H. Nutans x Steudelii

and several more varieties. In all cases, the result of the cross was a black, as deep in colour as the black parent, and in the F_2 the expected break up into *black* and *white* forms in the ratio 3 to 1 occurred. Some single cultures of the recessive character have been cultivated and not a single black eared individual has shown up. In one case, such a white form has been used for further crossing work with a *white* variety without showing even a tint of black in the progeny. Kezer and Baylock report the same result in a cross between California (white hulled) and Black Hulled.

Two-rowed condition dominant over Six-rowed.

When we come to this character there seem to be some differences of opinion, not so much as to refute the statement that two-rowed is not the dominant character, but more that there is incomplete dominance of the two-rowed. This Dr. C. E. Saunders, Dominion Cerealist, found to be the case in a series of crosses which he made at Ottawa. In a number of cases where he crossed a two-rowed on a six-rowed variety, in the F_2 generation all kinds of intermediate stages were obtained: from two-rowed to almost perfect six-rowed. In the F_3 generation, however, these almost perfect six-rowed acted as true intermediates, throwing off about 25 per cent. two-rowed, 50 per cent. like the parents and 25 per cent. six-rowed.

Other workers in the United States have noted this imperfect dominance with some certain varieties, an instance of which is furnished in a cross between Hanna, a two-rowed, bearded, and California, a six-rowed, bearded variety. In this case, true dominance with respect to beards was not found, but what could be called intermedium or better still heterozygous. The F_2 generation contained six-rowed types like the original California parent but carrying only two rows of awns down the central rows of kernels.

Hoods dominant over Awns.

Hooded or trifurcated heads are dominant to the awns, and numerous experiments have been made by different workers which have shown unmistakably that this character followed the Mendelian ratio of 3 to 1. Examples of parents carrying one or the other of these characters are provided by the following crosses:

Hordium trifurcatum x H. nutans.
H. rigens x H. atrum.
Black Hulled x Beardless.

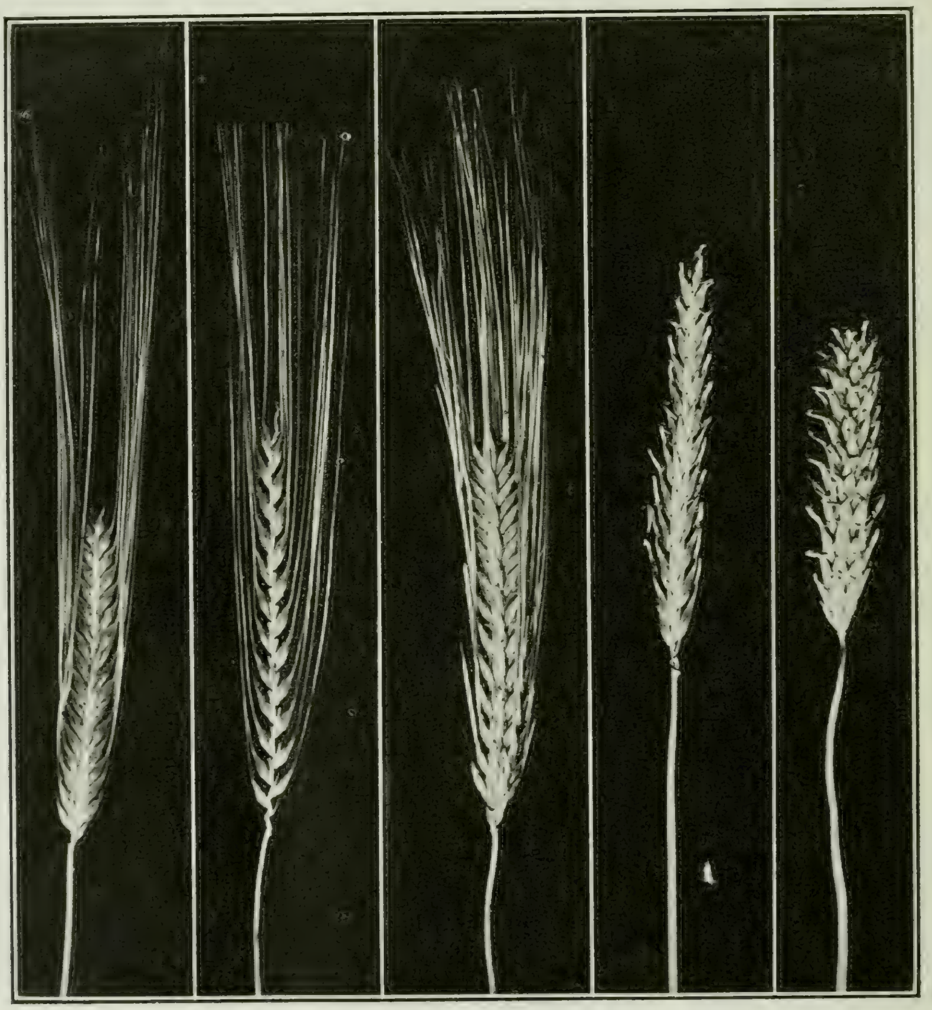
The F_1 generation, in all cases, bore hoods, the supernumerary florets being almost sessile. In the F_2 generation trifurcated and awned forms were produced in approximately the ratio of 3 to 1. In the F_3 generation, 45 *awned types* were tried and found to breed true; whilst the same number of *hooded types* were tested in which 16 bred true and 29 were found to produce a mixture.

Purple palea dominant over white palea.

It is to be noticed that in several varieties of barley the palea is a deep purple in colour before the grain has quite ripened, but as ripening progresses the colour fades and in the fully matured grain only a trace is to be noticed. From various crosses with these two characters, the progeny in the F_2 and F_3 generations followed the ratio 3 to 1. No intermediate shades were met with, so that it can be said that the *purple* shade is dominant over *white in the palea of barley.*

Coloured grain dominant over colourless.

The presence of colouring in the palea appears to be associated with the colour of the grain itself. In wheat, on the contrary, the coloured or colourless condi-



BARLEY TYPES

Dense Ear Type	Lax Ear Type	Common Six-row Type	Two-row Hooded Type	Six-row Hooded Type

tion of the glume has nothing to do with the colour of the grain. This may not express the facts clearly as in the F_2 generation a wide variation in colour is to be observed. Thus ears with black palea may contain grain which has variations of black, purple or violet green in the caryopsis. These shades may be faint, but can be classed as dark, if they show any colour at all.

Narrow glumes dominant over broad.

With most barleys, the glumes are narrow but there are varieties with ovate lanceolate glumes. When *H. Abyssinicum* and *H. Steudelii* or *H. Abyssinicum* and *H. trifurcatum* were crossed, the F_1 generation all had narrow glumes, but in the F_2 and F_3 generations narrow and broad glumes appeared and in the ratio of 3 to 1. Also, the broad glumes all bred true.

Lax ears dominant over dense ears.

As far as can be determined, lax ears are dominant over dense. In the F_2 generation, as Spillman was able to demonstrate in wheat, the heterozygote is intermediate between lax and dense. Cases have been recorded where the F_1 was laxer than the parent bearing that character. The F_2 has contained similar lax forms. Biffin expresses the opinion that the characters of laxness and denseness in the ears may be dependent on more than one set of characters.

Adherent palea dominant over non-adherent palea.

In cases where the parent has naked grain as it is in the wheats, the heterozygote seems to be rather intermediate between the parents. The grains rub out quite freely in some, while in others considerable difficulty is experienced in separating the palea from the grain. From experiments conducted to find out which character was dominant, on counting all individuals in which the palea could be separated from the grain, it was found that 76 could be grouped in the class in which the grain could be readily separated from the palea and 25 in the cloaked group. Sowings made from 20 plants with naked grain all bred true. Similarly, a like number of plants were tested in which the grain was enclosed and with 10 in which the grain was more or less enclosed. It was found impossible to draw a sharp line between these groups, as both heterozygous and homozygous forms were present. On further trials with similar characters, using other varieties and pressing the base of the rachis below each spikelet instead of rubbing, it was found that of 72 individuals so tested, 21 bore perfectly free grain and in the remainder the grain was more or less trapped, so that it would appear that this trapped condition comes very near to being dominant over the naked condition but due to the great difficulty of separating the forms in the F_2 generation, it is being treated at present as giving intermediate with partially naked grain.

Brittle rachis dominant over tough rachis.

A great many varieties of barley have this character of brittleness but not in any very marked degree, with the exception of *H. Spontaneum.* With this variety, the spikelets break away as soon as they become ripe. When this variety was crossed with a six-rowed, hooded variety with more or less tough rachis, as the ears ripened the rachis shattered and the spikelets were set free as with the parent. In the F_2 generation, numerous types were produced, as the original parents differed in several features, but the brittle and tough character was distributed in all types. The proportions were 56 brittles to 15 with a tough rachis, or roughly 3 to 1. It was found in the F_1 generation, that several of the hybrids were more brittle than the original parent.

Rough awns dominant over smooth awns.

Some varieties are known in which the awns are quite smooth because of the absence of the small teeth which, in most barleys, give to the awns their disagreeably tenacious character. The common form, with teeth, has been found to be dominant over the smooth form, the latter reappearing in twenty-five per cent. of the plants of the second generation.

Awnless condition dominant over hooded.

There has not been sufficient investigation on this subject as yet to give definite results on the inheritance of this awnless character. However, there has been a cross made, involving these characters in *H. nigrosubenerme* and *hexasticofurcatum.* This awnless character caused considerable interest when reported by Rimpau.

The F_1 generation resembled the awnless parent so closely that it was at first thought that the cross had missed. From the one poor plant harvested 27 beardless, 7 hooded and 7 awned were obtained. On some of the awnless plants small barbs 1 cm. in length were found. This being unexpected, it was thought that the parent might have been a heterozygote. Unfortunately, the plants were not kept track of and the author states that new work will have to be taken up.

Some other minor characters noted.

Long grained forms crossed with short grained gave long grained forms in F_1 generation and an excess of long forms in F_2. The broad ribbon-like awns in certain varieties like Japanicum, Himalayense and Paralleuum are dominant over narrow forms which occur in most barleys. Slight awns are dominant over lack of awns. The bristly form of rachilla in Goldthorpe is dominant over smooth rachilla as in Chevalier.

Conclusion.

It can be readily seen how little is really known on a lot of points in barley breeding and how much has yet to be done: how much difference of opinion there is on some matters depending on the view points of various workers. The appended table gives the generally accepted dominant characters.

Black colour in palea	dominant over White Colour.
Two-rowed	dominant over Six-rowed.
Hoods	dominant over Awns.
Purple palea	dominant over White palea
Coloured grain	dominant over colourless.
Narrow glumes	dominant over Broad.
Lax Ears	dominant over Denze Ears.
Adherent palea	dominant over Non-adherent
Brittle rachis	dominant over Tough rachis.
Awnless	dominant over Hooded.
Rough awns	dominant over Smooth Awns.

American Association for the Advancement of Science and Associated Societies

Meets in Toronto, December 27 to 31, 1921.

The seventy-fourth meeting of the American Association for the Advancement of Science will be held at Toronto, Canada, by invitation of the University of Toronto and of the Royal Canadian Institute. While it is not to be expected that the Toronto meeting will attain the great magnitude and complexity that characterized the recent Chicago meeting, yet it is certain to be exceptionally satisfactory in many ways. Not being one of the larger, four-yearly meetings which are scheduled to occur in rotation, at Chicago, Washington, and New York, the second Toronto meeting will be less crowded than are the larger meetings. Its program will be simpler, with fewer serious conflicts. It will excel especially in opportunities for personal and social contact among those in attendance, a very desirable and valuable feature of the Association meetings that is necessarily partially thrown into the background at the great four-yearly meetings.

It may be safely predicted that the seventy-fourth meeting will be exceptionally interesting and inspiring on account of its international character. More Canadian men of science will attend than is usual for meeetings held south of the international boundary, and the scientific workers of the two great English speaking nations of North America will here have opportunities for becoming even better acquainted than they now are, and for strengthening the bonds of mutual understanding and of personal and national friendship. Arrangements are in progress whereby, it is hoped, several British scientists may be present and give addresses at the various sessions of the second Toronto meeting.

The President of the Association for this year is Professor Eliakim H. Moore, of the University of Chicago, one of the distinguished mathematicians who have given American mathematics its prominent place in world science. Professor Moore will preside at the opening session, Tuesday evening, December 27, at which Doctor L. O. Howard, of the United States Department of Agriculture will present his address as retiring president of the Association. Dr. Howard is well known to

American scientists, through his excellent scientific work and in the organization of the United States Bureau of Entomology, as well as through his untiring services to the advance of science and education during his long and successful period as Permanent Secretary of the Association.

Many affiliated, or otherwise associated, scientific societies will meet with the Association at Toronto, for the reading of papers, for scientific discussion, and for the presentation of presidential addresses, and the sections of the Association will also hold sessions in many instances. The Association is becoming increasingly an affiliation and co-operative organization of the numerous special scientific societies of America and it is provided that the affiliated societies meeting with the Association shall have charge of the programs for the presentation of papers in their respective fields. Each of the retiring Vice-Presidents of the Association, one for each of its sections, will present his scheduled address on some aspect of his own special province.

The forthcoming meeting will be the first winter meeting to be held at Toronto. The only other Toronto meeting was held in the late summer, from August 28 to September 3, 1889. The report of the 1889 meeting indicates that the sessions were held in the Main Building of the University, in the Biological Building and in the Building of the School of Practical Science. The Main Building was destroyed by fire on February 14, 1890, less than six months after the close of the meeting. It was rebuilt, however, shortly afterwards, and since then a great complex of buildings has grown up in its neighborhood, but it continues to be the center of University activities.

The registration for the first Toronto meeting was 424. At that time the membership list of the Association contained 1,952 names. For the second Toronto meeting the list will contain about 12,000 names.

THE ORGANIZATION AND WORK OF THE ASSOCIATION.

General Scope.

Through its meetings and through its publications, the American Association promotes intercourse and co-operation and the feeling of fellowship among scientists and those interested in the advance of science and education. North America and South America are its special geographic fields, but members may be citizens of any country.

The Association has become a great affiliation of American scientific societies, and its meetings have become increasingly characterized as conventions of many special organizations. A large number of the associated societies regularly meet with it and the facilities of the Association are always at the disposal of these societies, for the arrangement of meetings, the preparation of programs, etc. Many associated societies are also officially affiliated and are represented in the Council of the Association, thus taking part in its direction.

Meetings.

The regular annual meetings and the other meetings that are occasionally held constitute a powerful means of disseminating knowledge, of cultivating the scientific attitude of mind, and of promoting a general appreciation of the great importance of science and scientific study. It has frequently been stated that the progress of democracy depends mainly upon these things, and the truth of this statement becomes increasingly emphasized as science and the work of scientists becomes better understood by the public.

The meetings also furnish the only means by which a large number of active workers in all branches of science are brought together from distant regions, with consequent opportunities for the formation and renewal of numerous personal acquaintanceships and friendships. These meetings do much toward preventing the development of the undesirable aspects of personal rivalry and toward the encouragement of friendly co-operation among those interested in science and education.

Dr. J. C. Fields, F. R. S. Professor of Mathematics, University of Toronto and Professor of the Royal Canadian Institute, is Chairman of the Local Committee for the Toronto meeting.

Mr. H. L. Seymour, C.E., is the Secretary, and may be addressed at the Royal Canadian Institute, 198 College Street, Toronto, Ont. — Contributed by the Association.

Some Difficulties in Fruit Breeding

By M. J. DORSEY
West Virginia Experiment Station,
Morgantown, West Virginia. *

It is the purpose of this paper to discuss briefly some of the difficulties in fruit breeding which appear to be inherent in the material with which we have to deal. The time element has entered into some of the breeding attempts sufficiently to bring many of the difficulties to the foreground. A careful consideration of these may now indicate the limitations of the present method of attack from the genetic point of view.

Since the process of crossing is so basic to all breeding attempts the subject at hand may be approached from that point of view. The genetic relationship of varieties and species may be summarized under four headings — self-sterility, cross-sterility, self-fertility, and cross fertility.

In horticulture, self-sterility and self-fertility may be viewed from the standpoint of the individual flower, the variety, or the clone. This condition, strictly speaking, may be limited by some to the relationship between the pollen and pistil of the same flower or, under the monoecious condition, to the pollen and pistils borne on the same plant but in different flowers. The self-sterile or the cross-sterile condition is of chief interest in this connection because of the limitations placed upon breeding. Many apparently desirable points of attack are closed by self— and cross-sterility, and many more have to be abandoned after careful crossing attempts fail. If a large progeny is necessary or desirable even partial self—or cross-sterility may be as effective in blocking the way.

But self and cross-sterility are not the only limitations in breeding horticultural plants. In some self-pollinated progeny there is sometimes such a great reduction in vigor as to practically prohibit fruitfulness. This condition has been especially oustanding in selfed seedlings of the apple and grape. While theoretically when these selfed seedlings of reduced vigor are inter-crossed at least some of their progeny should again regain vigor, actually, the breeding work with the long time crops has as yet not been carried that far. If in succeeding inbred generations there is still further loss of vigor the point may eventually be reached when lessened fruit production would interfere with further inbreeding. This may not happen, however, and, as in some of the cereals, a point may be reached where there is practically no further reduction in vigor. Furthermore, it should be kept in mind that selfed progeny of all of the F. seedlings may not exhibit the same reduction in vigor.

Emphasis is placed upon this point here because one of the most effective approaches to breeding problems is by means of homozygous parents for the characters of greatest importance or interest. This can be done only through inbreeding. The formula in common use in determining the percentage of homozygous individuals in any selected generation following a cross is $(2n - 1/2n)^m$ where n = the number of segregating generations, and m = the number of separately inherited alleomorphic pairs.

It will be seen therefore that in sterility or fertility and in loss of vigor we have characteristics of horticultural plants which must be taken into consideration. It should not be inferred, however, from the above discussion that the loss of vigor encountered in many crosses must of necessity be general. This point has not been adequately tested in horticultural plants, largely because any breeder must consider vigor as one of the most important characters in selecting new types. This being the case it would require some courage and confidence in the ultimate outcome to continue inbreeding apples with, say ten years between generations for any number of years when great reduction in vigor is encountered. It should be stated here, in view of the above, that most of our important commercial varieties of fruits are

* Formerly in charge of the Section of Fruit Breeding, Department of Horticulture, University of Minnesota, St. Paul, Minnesota.

vigorous in growth and have gained their place commercially largely because of it.

Sterility has still another bearing upon breeding work. Recent investigations have shown that arrested development may take place at many stages in the development and functioning of the complicated sex mechanism. Viewed from the genetic standpoint arrested growth at any stage, whether in the gamete or in the zygote, has its greatest influence upon breeding results by eliminating factor combinations which may be in many respects particularly desirable.

When pollen development is studied in fruits it is found that in a large number of varieties, especially those which are interspecific hybrids, there are varying amounts of aborted pollen. The outstanding exceptions are varieties in which only one species is represented. In some instances aborted pollen is the limiting factor in fruit setting either in crosses or in the orchard. If the aborted grains represent certain factor combinations which cannot be brought to maturity and the grains which do reach maturity represent those which can, then it will be evident that where aborted pollen occurs only a part of the possible genetic combinations can be made.

Likewise in embryo development, as in pollen development, arrested growth before maturity eliminates many possible new types even in large progeny. If this is a correct statement of the condition found to be so general, then the limitations upon breeding work with horticultural material, may be much greater than has been supposed.

Considering now arrested development in the zygote, which must of course begin with the fusion of gametes which have been able to mature or survive as noted above, it will be clear that still further elimination may take place between fertilization and seed maturity. Then, in the seed bed the failure of seeds to germinate results in further loss of gametes, among which may be factor combinations which germinate with difficulty, if at all.

By following the formation of the gametes and zygotes through in detail it will be seen therefore that many possible combinations may be eliminated when they are suppressed or aborted in growth. The extent to which this takes place will be appreciated by those who have attempted breeding work on a large scale and who have made note of aborted pollen and pistils, of the number of flowers which failed to set, or the number of seeds which failed to grow.

These inherent characteristics of horticultural material are exaggerated in interspecific hybrids. Since these are so outstanding in fruit characters in many of the variety lists and consequently furnish what appears to be the most promising combinations to make in breeding experiments, the difficulties in breeding seem to be increased accordingly. This is especially true in view of the fact that interspecific hybrids appear at present to be the only method of obtaining varieties suitable to some localities. The origination of interspecific varieties will be continued therefore in spite of any handicap but with reduced efficiency.

In view of sterility and loss of vigor the heterozygosity of horticultural material for so many characters will render it difficult to develop breeding stock of known genetic constitution. This will be especially true when the time element is taken into consideration in long time crops. These considerations constitute some of the main obstacles to immediate progress. The problem should be approached with the object of studying the material at hand for fundamental knowledge rather than obtaining immediate practical results as has heretofore been the primary object. The fact should not be lost sight of, however, that vegetative propagation and the relative permanence of the clone counterbalance in part, at least, some of the difficulties pointed out above.

Breeding experiments then are not simplified by some of the characteristics of our material and the problem of the interspecific hybrid becomes even more difficult when these limitations are taken into consideration. With the above discussion in mind it may be encouraging to consider briefly some of the outstanding things already accomplished in breeding horticultural crops.

We should not lose sight of the fact that many varieties of outstanding merit have already come from breeding attempts. This is true with some fruits, as the grape or plum, to a greater extent than with

others. As a result of the studies of known hybrids considerable has been learned of the inheritance of characters in fruits. In addition the last half century has seen a broadened interest in foreign fruits, and many of these have been sufficiently tested in the different regions to determine their economic promise, and breeding experiments have in part shown their possible value in this direction. At the same time attention has also been centered upon the native species. Finally the outstanding result from the applied standpoint of breeding work to date has been a determination of the most valuable varieties for parents in many of the fruits. From the economic standpoint this is of great significance and importance because the best parents indicate the immediate point of attack in developing better varieties. It will be seen therefore that while much stands in the way of further work, much has been already accomplished.

If the above point of view is correct, then the method of attack which appears to be most promising of results may be summarized as follows: First, follow through in detail the development and functioning of the sex structures, noting particularly the points in the life cycle where essential organs are suppressed. These have a direct bearing upon the possible combinations and upon Mendelian ratios and hence upon the interpretation of results. Second, study the progeny of each controlled cross in the different fruits carefully to determine the parents giving the best progeny from the economic standpoint. These will indicate the future lines of work. Third, study the inheritance of characters in the available material of known crosses with the view of advancing the genetic knowledge of the material. This knowledge will indicate the progress made. All of these suggestions presume a knowledge of horticulture on one hand and of genetics on the other — both broadly interpreted.

The Possibility of the Transmission by Asexual Propagation of the High Yielding Ability of Individual Apple Trees

By M. B. DAVIS

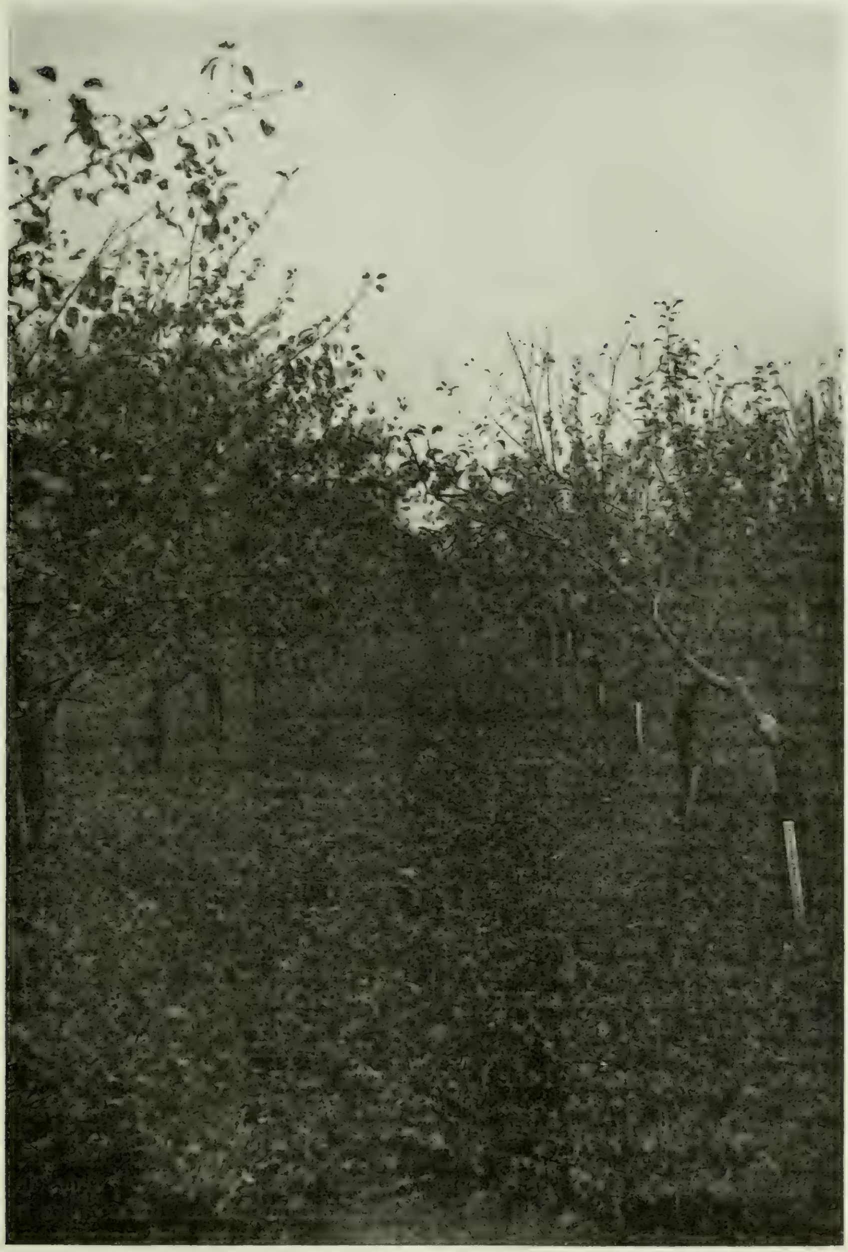
Assistant Horticulturist, Central Experimental Farm, Ottawa.

Attention has frequently been called to the fact that individual apple trees, growing under similar conditions and receiving similar treatment, vary considerably in the quantity of fruit produced. Macoun in 1901 called attention to the marked individuality of Wealthy, McMahon and Patten's Greening apple trees with regard to yield.

Munson dwells at some length on the possibility of improving our existing varieties simply by bud selection and says in part: "If the differences in the buds of a tree or other plant can be perpetuated by asexual means, as by cuttings, grafting, etc., it is evident that this method can be depended upon for the systematic improvement of existing varieties, and with most of the commonly cultivated fruits such improvement is vastly more important than a wholesale production of new forms."

Some of the diverse results of latter day experiments in clonal or bud selection leave the field in a still unsettled condition. Shamel has shown that clonal selection in connection with the California navel orange is a practical and profitable undertaking and has succeeded in isolating superior types through this method. Propagation from trees of known performance is the practice now, rather than the promiscuous propagation from not only bearing trees, but nursery rows. Shamel considers that there is a possibility of fruits other than the citrus being improved by this method, and says, "If this work is carried on carefully and honestly and based upon adequate investigation of the conditions in each of the varieties concerned, it will doubtless result in as marked an improvement in orchard production as has been the case with the citrus in the opinion of the writer."

At the Missouri Station Gardner reports the results from an experiment conducted with scions from a high-yielding Ben Davis



Showing row of highest yielding progeny (on the left) and row of lowest yielding progeny. Note the larger size and greater vigor of the trees propagated from the highest yielding tree.

apple tree and a low yielding tree of the same variety, both trees being apparently of equal vigor, but different in the respect that one produced large crops of fine quality fruit, while the other produced small crops of poor or inferior fruit. In reporting on the results of the yields of the progeny of these two trees, Gardner states that there has been no apparent difference in favour of the progeny from the high yielding parent. We apparently have here positive results from bud selection with citrus fruits and negative results from the same type of selection with the apple. In the first case the somatic variations noted have been of such a nature that they are permanent or fixed and may be perpetuated by the means of asexual propagation. In the second instance (that of Gardner) the variations observed were evidently of a fluctuating nature caused either by environmental influences or nutritional differences within the two parent individuals, unobservable to the human eye. It is evident, therefore, that before final judgment is passed upon the efficacy of or the possibility of improving existing varieties of apples by this method, further experimental data will have to be accumulated.

It is not the intention of this article to take up in detail all the accumulated data for and against bud selection; the foregoing instances are merely cited as examples of opinions, and experimental results having a bearing on this question.

Attention may now be turned to the results of an experiment in bud heredity conducted at the Central Experimental Farm, Ottawa. Since 1896 a record of the yield of individual trees has been kept at that Station. In 1906 scions were taken from the heaviest yielding, the poorest yielding, and the heaviest most regular yielding Wealthy trees. The variation of the three parents was:

Heaviest yielding: Total crop for 8 years, 104¾ gallons.

Poorest yielding: Total crop for 8 years, 41 gallons.

Heaviest most regular yielding: Total crop for 8 years, 78¾ gallons.

With regard to the quality of the fruit produced, no apparent difference in favour of either tree was observed, and with reference to the comparative size and vigor of the three parents, although all were normally healthy, the poorest yielding tree was somewhat smaller than either of the other two, although no record of girth or other measurement was taken.

The scions taken were root grafted on Rose of Stanstead and Dartmouth crab stock and planted in the same orchard on as uniform soil as was possible to obtain.

The tables on page 123 give the result of each individual tree up to the end of 1920. A discussion of the results follows.

Discussion.

It will be noticed that the progeny of the poorest yielding tree has given on the average the lowest yields; that the progeny from the heaviest and most regular bearer has given the second highest; and that the progeny from the heaviest total yielder has given about 62 per cent. more crop on the average than the progeny from the poorest yielding tree.

Furthermore, it is interesting to note the range of the yields of the individual trees of each lot. For instance, the progeny from the poorest yielding tree runs from 24 gallons to 49 gallons, as compared with 30.25 gallons to 77.25 gallons from the heaviest yieding progeny. Twelve out of a total of seventeen trees from the heaviest yielding parent gave total yields in excess of the highest yielding tree from the poorest yielding parent. Just what influence the stock may have had is difficult to say, for although all the stock used was grown from Rose of Stanstead and Dartmouth crab seed, each stock would be different in habit and individuality. Nevertheless, it is interesting to note the difference in girth or measurement of these lots of progeny. The progeny from the heaviest yielding tree is, from actual observation, as is illustrated by the accompanying photo, far superior in size and vigor to the progeny from the poorest yielding parent, while the progeny from the largest and most regular bearing parent are a close second in this respect. The girth measurements of the individual trees indicate this in a mathematical form. The row of trees propagated from the poorest yielding parent is uniformly lacking in vigor, as is evidenced by the appearance of the trees and by the large percentage of deaths, viz: 45.45 per cent. On the south side of this row is the row propagated from the heaviest yielding parent, with only 23.53 per cent. of deaths to date, and, with few excep-

tions, a uniformly vigorous row of productive trees. On the north of the poorest yielding progeny is the row propagated from the largest and most regular bearing tree, and this row shows only 17.64 per cent. of deaths and is also uniformly vigorous in appearance, although not approaching in this respect the heaviest yielding progeny. These differences are very marked and readily noticeable to the casual observer. There appears to be, therefore, in this instance a close relation between vigor and productiveness, which seems to have been isolated by clonal selection. As a more or less efficient check on the foregoing experiment, scions from the three parent trees mentioned were top-grafted on large, bearing trees in the Russian orchard. Five trees were used for this purpose and on each tree scions from all three parents were grafted, the position of

Yield of Progeny from Heaviest Yielding Tree in Wealthy Orchard, No. 4-4. Yield in gallons.

Tree	Grand total of each tree for nine years.	Circumference (inches.)
3-1	41.75	14½
3-2	66.75	16¾
3-3	62.	14
3-4	61.25	17½
3-5	66.5	14¾
3-6	77.25	16¾
3-7	30.25	14¾
3-8	63.25	17¾
3-9	56.75	16¾
3-10	70.	15¾
3-12	68.	16¾
3-14	54.5	15
3-16	46.75	17½
4-12	72.75	16½
4-13	34.5	14¼
4-15	62.	16
2-17	37.75	15¼
17	972.	

Average total yield per tree for 9 years

$$= \frac{972}{17} = 57.18 \text{ gals.}$$

Range from 30.25 gallons to 77.25 galls.

Yield of Progeny from Heaviest and most regular Bearing Tree in Wealthy Orchard, No. 4-5. Yield given in gallons.

Tree	Grand total of each tree for nine years.	Circumference (inches.)
5-1	39.5	13
5-2	41.25	14¾
5-3	23.25	11
5-4	23.50	14¾
5-5	52.75	15½
5-6	66.50	17
5-7	31.25	13½
5-8	45.50	16
5-9	54.	16¼
5-10	62.25	16
5-11	75.	16
5-12	65.75	13½
12	580.5	

Average total yield per tree for 9 years

$$= \frac{580.5}{12} = 48.375 \text{ gals.}$$

Range from 23.25 gallons to 75.25 gallons

Yield of Progeny from Poorest Yielding tree in wealthy Orchard No. 4-2. Yield given in gallons.

Tree	Grand total of each tree for nine years.	Circumference (inches.)
4-1	31.5	13½
4-2	49.	14
4-3	42.	14
4-5	42.	15
4-6	24.	12
4-8	25.	13
4-10	41.	14¾
4-11	27.5	13¼
8	282.	

Average total yield per tree for 9 years

$$= \frac{282}{8} = 35.22 \text{ gallons.}$$

Range from 24 gallons to 49 gallons.

each lot being changed on each tree so that on one tree the poorest yielding scions would be on the north side, while on the next tree they would have a southern exposure, etc. The limbs selected for grafting were as uniform as possible. The results from this check follow:

Yields for Five-Year Period, 1911 *to* 1915 *Inclusive.*

Tree No.	Poorest yielding progeny.	Largest and most regular yielding progeny.	Largest yielding progeny
	gallons	gallons	gallons
36-21	10.75	32.	25.25
44-13	15.	15.75	19.50
43-27	3.	30.50	12.50
42-25	.25	6.	5.
45-7	7.50	12.	16.50
Totals	36.50	96.25	78.75

It has only been possible to use the results for the first five year-period, as since that date pilfering and accidents have rendered the records from these trees unreliable. It will be noted, however, that here again there is a distinct difference in favour of the two high yielding progenies, although the progeny from the largest and most regular bearer has given a larger yield than that from the heaviest yielder. Nevertheless there is a distinct lack of productiveness of the progeny from the poorest yielding parent.

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THE STORAGE OF ICE.

The heated period of the past summer must have convinced at least the majority of people of the necessity and value of having a supply of ice for domestic use. On that account a bulletin issued by the Dairy and Cold Storage Branch of the Dominion Department of Agriculture, Ottawa, describing Simple Methods for the Storage of Ice is of special and immediate interest. The bulletin points out that any unoccupied corner of a shed may be made to serve the purpose. A rough board enclosure ten feet square and eight feet high will hold sufficient to provide 50 pounds per day for 130 days after allowing for a reasonable amount of wastage. An important fact to be remembered is that the smaller the quantity of ice stored the larger is the proportion of waste. The bottom of the enclosure should be covered with a foot of saw-dust, and a foot of space left between the boards and the ice which should also be filled with sawdust. The ice should be similarly covered. The drier the sawdust the better. If the soil beneath the enclosure is impervious clay, a layer of gravel under the sawdust is advisable. If sawdust is not obtainable, planer mill shavings will serve. If neither is to be had, two feet of marsh hay or any fine wild hay that grows in low places well packed will answer. If it is thought necessary to erect an ice-house, the roughest kind of a shed that will resist the weather is all that is required.

SOIL DRIFTING REMEDY.

Strip Seeding Experiment Commenced at Nobleford.

Strip seeding as an experiment to combat soil drifting has been commenced by the Noble Foundation at Nobleford, C. S. Noble announces. This experiment is a process by which crop is sown in strips at intervals across the land, and was one discussed by soil drifting experts at the irrigation convention in Lethbridge last year. Mr. Noble is the first to introduce the experiment in Southern Alberta.

He has large areas in rye this fall and has planted the crop in strips twenty rods wide and twenty rods apart across the western portions of his sections in crop. If wheat is planted in the other spaces, this method gives an alternative of stubble and crop, since rye matures early in the summer and wheat is harvested in the fall, thus giving an effectual protection against drifting. The Nobleford farms have about 11,000 acres in rye this fall.

Variation and Inheritance in Red Clover

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(Continued from last issue.)

II.—INDIVIDUAL VARIATION AND INHERITANCE OF CHARACTERS.

The Markings of the Leaves.

..Causes and occurrence of the markings.—Great variations occur, as is well known, in respect to the markings of the leaves. Most red clover plants have the leaflets marked with a white blotch which, according to *Kajanus* (2, p. 40), is being formed in the following way: The flattish epirdermis cells of the upper leaf surface multiply in certain areas at a faster rate than do the palisade cells underneath, the result being that spaces filled with air are created between the latter cells. At the same time the lower walls of the epidermis cells bulge out, giving the cells in question the shape of plano-convex lenses. As a consequence the palisade cells located underneath are being exposed to more intense light which, in turn, brings about a partial destruction of their chlorophyll. The markings of the red clover leaves are consequently caused by the presence of air-filled spaces between the palisade cells combined with a partial destruction of the chlorophyll in the said cells.

The white or whitish markings are generally located at or around the central part of the leaflets. In some plants however, they may be found towards the apex of the leaflets and, in others, although rarely, at the very base. While generally V-shaped, the markings have in many types the form of a small triangle or even almost a circle.

In some types the markings are very obscure and in others they are absent altogether. The absence of markings has, by the way, sometimes been used to define certain commercial varieties. Thus, the English Cow-grass or Mammoth clover is generally said to lack the markings and as a consequence to be characterized by pure green leaves. This is, however, only approximately correct, as the Mammoth clover, or at least what is sold as Mammoth clover, generally seems to contain a large number of forms marked in the ordinary fashion. As, on the other hand, plants lacking the white markings are practically always found in any "variety" of Red clover, it is apparent that the presence or absence of leaf markings cannot be used as a reliable variety character (cfr. *Clark* & *Malte* 1, p. 105).

Hereditary Inheritance of the Leaf Markings.—Concerning the hereditary character of the leaf markings, some interesting investigations have been conducted by *Kajanus* and *Gmelin*.

Kajanus (2. p. 39) distinguishes between central markings, i.e., markings occurring at or about the centre of the leaflets, and basal markings, i.e., markings occurring at the base of the leaflets. In respect to the former *Kajanus* (2. p. 41) found, when studying the progeny of open-fertilized plants, that some of the plants displayed undoubted Mendelian segregation. Six plants gave the following progeny:

No. of mother plants.	Plants with central markings.	Without markings.	Total.
3589	101	54	155
3590	157	77	234
3537	129	28	157
3546	128	46	174
3548	144	46	190
3549	69	32	101
Total	728	283	1011

Kajanus concludes from this table, in the first place, that, as plants with and without markings were obtained at the ratio of about 3:1, segregation takes place in accordance with the mono-hybrid formula and, secondly, that the presence of leaf markings is dominant over its absence. The recessive character of the lack of markings was further substantiated by the fact that plants having no markings whatever gave, when open-fertilized, progenies showing an over-

whelming majority of plants possessing the usual central leaf markings. Had the absence of markings been a dominant character, it is apparent that the majority of the plants in the progenies would have been without markings.

Plants with basal markings were first observed by *Kajanus* in 1911, viz.: in the progenies of two plants, one of which had normal central markings and the other no markings at all. The plant having central markings gave when open-fertilized the following progeny.

Plants with central markings	75
" " basal markings	21
" without markings	11
Total	107

The plant having no markings produced a progeny as follow:—

Plants with central markings	40
" " basal markings	5
" without markings	11
Total	56

Kajanus concludes (2. p. 43) that, as in the first mentioned case the segregation appears to take place after the di-hybrid formula, there are two factors for the markings of the leaves, viz.: one for central markings and another for the basal one. He further concludes that central marking is dominant over basal.

Gmelin (2. p. 425-430) investigated the hereditary character of leaf markings by studying the progeny of both open-fertilized and controlled fertilized plants. He found that of 20 open-fertilized mother plants of the so-called Roosendaal clover, five produced a small percentage of plants without leaf markings. Among a total of 953 descendants from the twenty mother plants, only 23 were lacking leaf markings, or about 2.4 per cent. Of eleven also open-fertilized mother plants of so-called Maas clover, five gave a small number of plants having no leaf markings. Among a total of 527 descendants from the eleven mother plants 25,or about 4.7 per cent, showed no signs of leaf markings. These figures evidently indicate the dominant character of presence of markings.

Particularly interesting are *Gmelin's* studies of the leaf markings on controlled-fertilized material. In these studies, he worked with pairs of two plants, each pair isolated together and then cross-fertilized. The various pairs fall into three groups, viz.:

Group 1: composed of pairs of which the one component had leaf markings, the other not.

Group 2: composed of pairs of which both components were without leaf markings.

Group 3: composed of pairs of which both components possessed leaf markings.

The first group contained one pair of plants of Roosendaal clover and one pair of plants of Maas clover. The two components of each of the pairs were intercrossed, with the following results:

Roos. cl. without markings x Roos. cl. with markings; progeny 48 plants, all with markings.

Roos. cl. with markings x Roos. cl. without markings; progeny 48 plants all with markings.

Maas cl. without markings x Maas cl. with markings; progeny 44 plants of which 26 with and 18 without markings.

Maas cl. with markings x Maas cl. without markings; progeny 46 plants, of which 27 with and 19 without markings.

From these results several conclusions may be drawn. In the first place it appears that, if two plants are inter-crossed, their respective progenies will show the same hereditary complexion. In other words, in crossing two different types it is immaterial whether the one or the other is used as the female parent. Secondly, presence of leaf markings is dominant over its absence. Thirdly, the appearance or non-appearance of the recessive character, i.e., lack of leaf markings in the progeny depends upon the sexual complexion of the parent having the dominant character. In the case of the Roosendaal clover pair, the plant with leaf markings was evidently monozygous in respect to the Mendelian factor or factors for leaf markings; in the case of the Maas clover pair, the plant with leaf markings was heterozygous.

The second group contained four pairs of plants, all without leaf markings. The progeny of three of the pairs showed no

leaf markings at all, while the progeny of the fourth pair consisted of 16 plants with markings and 31 without. In the latter case, however, *Gmelin* is inclined to think that the character of leaf marking was present in at least one of the parents, although in such an obscure form that it escaped detection when the parent plants were selected as representatives of types having no leaf markings.

The third group contained sixteen pairs of plants, all with leaf markings. Of these, only three produced a progeny in which plants without leaf markings were present. The ratio of plants with and without leaf markings obtained from the said three pairs being 40:6, 32:15, and 40:8 respectively, *Gmelin* concludes that *there are at least two Mendelian factors for leaf markings in Red Clover,* a fact which, indeed, may *a priori* be considered likely in view of the great variation found in the character in question.

Concerning the practical application of the results of the investigations briefly related, it may be added that *Gmelin* succeeded in developing several races of Maas clover which all, however different in other respects, are characterized by lack of leaf markings (3. p. 1).*

Polyphylly and Fasciation.

Occurrence of Polyphylly:—While the red clover leaf generally is trifoliate, i.e., is composed of three leaflets, individuals are frequently found, as is well known, in which a smaller or greater number of the leaves are polyphyllous, i.e., are composed of more than three leaflets. Individuals are also found in which leaves with less than three leaflets occur. In the case of polyphyllous plants, the number of leaflets may vary from four to nine, the general rule being that the greater the number of leaflets to a leaf, the rarer its occurrence.

As an example illustrating the relative frequency of the occurrence of leaves other than trifoliate may be mentioned a case investigated by *Kajanus*. *Kajanus* (1 p. 64-66) found, in 1910, a specimen having eight 4-foliate and six 5-foliate leaves. The seed of this plant was harvested separately and subsequently sown. A total of 131 plants were obtained of which 71 were more or less polyphyllous and 60 normal, i.e., 3-foliate. The frequency of polyphylly in the 71 plants was further studied and was found to vary considerably. Some plants had less than one per cent polyphyllous leaves, while others had between sixty and seventy per cent. A total of 15,897 leaves from the 71 plants were found to have a number of leaflets as follows:

	1 fo.	2 fo.	3 fo.	4 fo.	5 fo.	6 fo.	7 fo.	total.
No.	19	57	14348	1089	341	33	10	15897
p.c.	.12	.36	90.25	6.85	2.15	.21	.06	100

In connection with the occurrence of polyphyllous leaves in a given plant, *Kajanus* (1. p. 67) further made the observation that 3-foliate leaves appear first; later appear 4-foliate, 5-foliate, etc., until the maximum development of polyphylly has been reached, after which a gradual return to leaves with a smaller number of leaflets takes place. The latest leaves thus become 3-foliate, or in cases, even 2 or 1-foliate.

Formation of Polyphyllous Leaves:—Polyphyllous leaves are developed from typical 3-foliate leaves by the splitting, on an early stage of development, of one or more of the three original leaflets. This splitting, however, may take place in a different manner in different cases. Thus, *Tammes* (1), and *Kajanus* (4) distinguish between two kinds of splitting, viz.: lateral and median. In the first case the splitting takes place laterally of

*In a previous paragraph it has been explained that the presence of leaf markings is associated with a partial destruction of the chlorophyll in the palisade cells underlying the marked areas. As the palisade cells constitute the chief assimilating tissue of the leaves, it stands to reason to surmise that leaves with markings assimilate less than leaves which are wholly green, and that the larger and more conspicuous the markings are, the more is the assimilatory function of the leaves impaired (*Kajanus* 5. p. 2-3). The development of races or varieties lacking leaf markings is therefore not only of theoretical interest, but also of practical importance.

the central vein of a leaflet, one of the original lateral veins becoming the central vein of the new and supernumerary leaflet. In the second case the splitting takes place through the centre, or median, of the original central vein of a leaflet. In either case the splitting may manifest itself differently, depending on what stage of development of the embryonic leaflet it takes place. If it takes place very early, new and independent leaflets are originated, the result being an increase in the normal number of leaflets. If it takes place at a comparatively late stage of development, the result is that more or less deeply cleft leaflets occur.

The development of polyphyllous leaves is often connected with the so-called fasciation, i.e., the broadening and flattening of either the stems or the pedicels, or both. In such cases a marked increase in the number of the fibro-vascular bundles has been observed (*Kajanus* 4), which in turn may favor not only the development of supernumerary leaflets, but also the development of whole supernumerary leaves. Polyphylly is, indeed, regarded by *Kajanus* as a mere form of fasciation, as are also certain other anomalies such as "trumpet" shaped leaflets for instance.

Inheritance of Polyphylly:—The nature of polyphylly was first thoroughly studied by *de Vries* (2. pp. 435-449). In 1886 *de Vries* found two red clover plants which had several 4-foliate leaves and one 5-foliate. In the progeny of these plants, represented by a little over one hundred individuals, about fifty per cent of the plants were found to produce at least one 4-foliate leaf. By selecting and propagating four of the plants showing polyphyllous tendencies *de Vries* obtained in the next generation an increased number of polyphyllous plants, nearly 80 per cent. of the progeny having one or more 4-foliate leaves. By repeated selection through six generations *de Vries* finally succeeded in developing or rather isolating a distinct variety which he called *Trifolium pratense quinquefolium*. It is characterized by having leaflets varying in number from four to seven around a mean of five.

De Vries ascribes the development of polyphyllous leaves in his variety to the existence of a latent or semi-latent character which manifests its presence particularly under favorable conditions of life. In explaining the presence of this latent or semilatent character *de Vries* bases his contention on the supposition that the remote ancestors of the clovers had pinnate leaves, a view which is shared by other botanists and is supported by, among other things, the appearance, now and then, of true pinnate leaves instead of the ordinary multifoliate ones. If this contention is correct, i.e., if the trifoliate leaves of the clovers are derived from Leguminosae with pinnate ones, the phenomenon of polyphylly must evidently be regarded as an atavistic one. This tendency to atavism may be intensified, so to speak, under favorable conditions. Thus, *de Vries* found that the better the seeds are nourished on the parent plant the more prominent becomes the development of polyphyllic leaves in the individuals produced by them.

In explaining the inherent nature of polyphylly, *Kajanus* at first (1. p. 69-70) endeavored to explain the appearance of polyphylly in Mendelian terms. Like *de Vries*, he assumed that the trifoliate clovers have been developed from ancestors having pinnate leaves. He attributed the original reduction of the number of leaflets to the development of inhibition factors which, as long as they are functioning normally, keep down the number of leaflets to three. Should, however, for some reason or other, the vigor of the inhibition factors become impaired, the result would be the appearance of polyphyllous plants. Such plants would produce equal numbers of egg cells and pollen cells with and without inhibition factors. Consequently, seed developed by such plants after fertilization by pollen from normal plants would theoretically produce fifty per cent polyphyllous heterozygotes and fifty per cent normal homozygotes. *Kajanus* finds support for this theory in the fact that he received, after open- fertilization of the first polyphyllous plant secured, 71 polyphyllous ones and 60 normal ones, the theoretical figures being 65.5 for each.

As a result of further investigations,

however, *Kajanus* (4. p. 129-130) finds it rather doubtful whether polyphylly should be regarded as an atavistic phenomenon. It certainly cannot be so regarded if the polyphylly really is a form of fasciation caused by an increase in the number of the fibro-vascular bundles, because in such a case the increase in the number of the fibro-vascular bundles may be due to a more vigorous growth brought about by a more plentiful food supply. The apparent inheritance of the polyphyllous tendency may then be looked upon as a kind of pseudo-heredity. Such an explanation seems to agree fairly well with the observations made by *de Vries* (2) which are to the effect that the polyphylly manifests itself more vigorously in the progeny of well nourished seeds, and also with observations made by *Kajanus* himself. *Kajanus* (4. p. 122) had, in 1911, several individual plants growing, which were characterized by fasciated stems, split pedicels, and polyphyllous leaves. These plants, when transplanted and thereby weakened, the following year, exhibited the said characters either very indistinctly or not at all.

Finally may be mentioned that *Perriraz* (1) (according to Exp. Sta. Rec. vol. 35. 1916, p. 329) "concludes a discussion of his observations by stating that the appearance of supplementary leaflets in the different species of clover is due to heredity or to nutritive factors. These may be distinguished, as the latter appear on the same plan as the normal growth, while the former appear on a different plan."

The Colour of the Flowers.

Variations in the Colour:—Concerning the colour of the red clover flowers it is a well-known fact that all kinds of shades occur between deep-purplish red and pale red. Sometimes a certain shade of flower colour is characteristic to certain varieties, particularly to varieties referred to as geographical ones on a preceding page. Thus, certain local varieties have deep-red flowers, others bright-red, and still others pale-red ones. In ordinary commercial red clover, however, all kinds of shades of red may be readily distinguished.

It is also a well-known fact that white flowers are occasionally found. In instances, the appearance of the white colour is sufficiently constant to have caused certain types to be classified as distinct botanical varieties, as for instance the Alpine clover of central Europe (*T. pratense* L. var. *alpinum* Hoppe) which has dull white or ochroleucous flowers with sometimes a tendency to become reddish. Ordinarily, however, the white flowered plants occur more sporadically and irregularly among red-flowered ones.

Red flowers with a bluish tinge have often been observed. Indeed, there are local varieties in Europe characterized by distinctly bluish-red flowers. Very rare, however, are purely blue ones. Such flowers were observed, or at least recorded, probably for the first time, by *Kajanus* (3. p. 764) in a progeny of so-called Toten clover from Norway. They occurred in several shades, viz.: purplish blue, bright blue, and pale blue.

Dominance of the Red Colour:—The inheritance of the red flower colour has been particularly studied in its relation to white. *De Vries* (3. pp. 154-155) fertilized, in 1895, a white-flowered plant of American Red clover with pollen of ordinary typical Red clover and found that all the plants of the F_1 generation possessed red flowers. From the F_1 generation, the seed of which was harvested collectively, 219 plants were obtained, 25 per cent of which were white-flowered and 75 per cent red flowered. Another cross obtained another year between a white-flowered form of European Red clover and the ordinary Red clover gave also an exclusively red-flowered F_1 generation, showing that, in this case also, red was dominant over white.

Observations by *Kajanus* (3. pp. 765-66) also most decidedly indicate that the red colour is dominant. Thus, the progeny of a white-flowered plant growing among ordinary red-coloured ones proved to consist of 246 red-flowered individuals and only 2 white-flowered ones. Another plant of a pale-red colour produced a progeny varying in colour from deep-purplish red to white, the latter colour however appearing in very few specimens. In both cases the dominance of the red colour was apparent.

In inter-crossing pairs composed of one

white and one red-flowering plant, *Gmelin* (2. p. 417) obtained different results in two different cases. In one case he obtained a progeny composed exclusively of red-flowered individuals, the result of course clearly indicating dominance of red over white. In the other case, both the red-flowered and the white-flowered component of the inter-crossed pair produced white flowered offspring. The former produced 58 plants of which 29 were red-flowered and 29 white-flowered. The latter produced a progeny of 258 individuals of which 155 were red-flowered and 103 white-flowered. In this case the appearance of the white-flowered plants in the progeny was evidently due to the fact that the red-flowered parent plant was heterozygous for the red colour.

Taking all evidence into consideration the dominance of red over white in the flowers of Red clover may be considered satisfactorily proven.

Concerning the blue-colored Red clover flowers, results obtained by *Kajanus* (3. p. 764) seem to indicate that the blue colour is recessive to red.

The Genetic Complexion of the Red Colour: — The information available on the genetic complexion of the red colour is so far rather scant. It has been studied by *Kajanus* in progenies of plants having red flowers of different shades and by *Gmelin* in connection with the development of white-flowered plants from red-flowered parents.

Kajanus (3. p. 765-66) came to the conclusion that intensive colouring expresses a more complicated genetic constitution than does light colouring, and that the segregation in deep red and light red colour types as found in the progenies studied indicates the presence of two Mendelian factors for red.

Gmelin (2. p. 423) arrived at a similar conclusion; only he intimates that in all probability several, i.e., more than two, factors for red may occur.

The inheritance of the white colour:— Having found that the white colour does not dominate over the red, *Gmelin* (2. p. 416) undertook to investigate the possibility of developing a constant white-flowering variety. He selected for the purpose two white-blossomed individuals, isolated them together, and then inter-crossed them by means of bumble bees. He thus obtained seed from both plants which later was sown. From one of the plants he obtained a progeny of about 210 individuals, all with white flowers. From the other about 450 individuals were secured of which all flowered white except two which had red blossoms. In the latter case, however, *Gmelin* observed that the two red-flowering individuals were of a quite different type in general than the others, i.e., those which had white flowers. Indeed, their appearance and their morphological characteristics were so strikingly different that he concluded that they must have been the result of accidental crossings; the humble bees used for the pollination of the isolated plants presumably have carried a few pollen grains from outside plants with them when set to work inside the isolation cage.

However that may be, *Gmelin* has conclusively shown that it is comparatively easy to develop constantly white-flowering red-clover varieties.

The inheritance of the blue colour:— As already mentioned, blue-flowered red clover plants were first observed by *Kajanus* in the so-called Toten clover from Norway. In the year 1911 a total of 7 blue-flowering plants were observed. Their seed was harvested separately and the following spring the seed of three of them was sown, with the result that late in the fall a total of 372 flowering plants were obtained which produced red and blue flowers as follows:

No.	No. of red-flowering plants.	No. of blue-flowering plants.	Total	Relation
871	137	8	145	17.1 :1
872	104	7	111	14.9 :1
873	114	2	116	56 :1
			Average Relation	20.9 :1

Kajanus later succeeded in propagating the blue type and states (5. p. 3) that in 1914 he had "quite a large number of such plants."

The Characters of the Seed.

The variation in colour:—Commercial samples of red clover seed show, as is well known, a very great variation in respect

to the colour of the individual seeds. In some seeds only one colour occurs, while in others more than one are present. Yellow, pink, various shades of purple, and combinations of yellow and other colours are common in practically all samples, while white seeds are only very rarely found. As a rule dark-coloured samples, i.e., samples in which the pink and purple colours predominate, are popularly considered more valuable than light-coloured ones and, this being the case, it is of particular practical interest that the real nature of the colour variation is thoroughly understood.

In order to come to as clear an understanding as possible of the question, the causes of the appearance and the development of the colour in the individual seeds may briefly be referred to. *Preyer* (1. p. 10) has shown that the colour of the seed is due to the presence of a colouring substance in the palisade cell-walls. Micro-chemical investigations undertaken by him have further revealed that the colouring substance is anthocyan, in the various shades of which evidently are closely determined by physiologico-chemical processes during the ripening of the seed.

Considering the nature and physiologico-chemical development of the colouring substance, it is obvious that red clover seed may exhibit different types of colour at different stages of development. This is especially the case, of course, with such seeds as are, when ripe, richly red or purple-coloured. Thus *Scribaux* (1) observed that the seeds that ripen first or, which amounts to the same thing, the biggest seeds are of a darker shade than those that ripen last. A similar observation was made by *Martinet* (1) in respect to differences in shade in seed from heads on different stages of ripening. *Martinet* found that in 23 plants of 73, all of which had many heads in different stages of ripening, those heads which were older and consequently contained a larger percentage of fully matured seeds, had seeds of a darker shade than those heads which were not as far advanced. *Gernert* (1. p. 87) also states that "seeds lighter in colour are frequently found at the tip and extreme base of the head, this being no doubt caused by poor development and immaturity," an assertion substantiated by the observation that "when clover seed is harvested immaturely it shows little or no purple and is usually white or pea colour, which may change to yellow, especially when the seed is cured improperly."

From the above it is evident that, in order to secure reliable evidence as to the colour characteristics of the seed of red clover, it is necessary to examine plants which have fully ripe or, still better, dead-ripe seed. Such examinations have revealed that all the seeds in a given plant are of the same general colour. Thus *Scribaux* (1) states that the seeds from individual plants present an almost complete uniformity and a similar observation is made by *Gernert* (1. p. 85). *Martinet* (1) relates that in 43 out of 73 plants examined the colour of the seed was uniform within the individual plants, notwithstanding the fact that the various heads of the individual plants were on different stages of development. Finally, a statement of the writer may be quoted on the subect (*Malte,* 1. pp. 530-31) as follows:- "The author collected, during the past summer, seed from about 250 individual plants of red clover, the majority of which were growing in British Columbia and western Quebec. In all cases the seed from each individual plant was found to be perfectly uniform as to the general type of colour, although slight modifications in shade were frequently, but not always present. Although in these investigations no special attention was paid to possible differences in the colour of seeds from heads at *a different stage of development* it might be safely stated that in many cases it is not possible to detect any difference in shade from such heads. This is especially the case in such plants as have entirely yellow or entirely purple or violet seed, whereas differences in shade are more often marked in seeds of more than one colour. Even if those graduations in colour really exist, they do not affect the above statement, that all seeds in a given

plant have a certain type of colour (meaning a uniform type of colour)*

The inheritance of the seed colour:—The information available on this subject is rather fragmentary and incomplete, but nevertheless not without interest. *Kajanus* (3. pp. 768-772) found that plants originating from seed of mother plants having dark-purplish seed to a large percentage also possessed dark-purplish seed. In four cases mentioned the percentage of the dark-seeded plants in the progenies varied from 65 to 95 per cent, the figures obtained indicating that mother plants having the most intensively purple seed are liable to produce a larger percentage of daughter plants with dark-purplish seed than are mother plants having seed of a less pronounced colour. Not a single pure-yellow seeded plant was obtained from the four dark-purple seeded mother plants mentioned. A yellow-seeded mother plant, the progeny of which was also recorded, produced about 13 per cent plants with pure-yellow seed, the balance having seed ranging in colour from yellow with a purplish tinge to a very dark purplish. From these and other observations made *Kajanus* concludes that dark-purplish seed colour is dominant over lighter-purplish and that both are dominant over yellow. *Gmelin's* (3. p. 12) observations on the subject are also to the effect that the general type of seed colour is hereditary although its hereditary nature in circumstances may be somewhat obscured as a result of the cross-fertilization which, as already pointed out, it is necessary to resort to in order to obtain germinable seed.

Although few and incomplete, the observations made are important from a practical point of view in as much as they indicate, as the writer (*Malte* 1. p. 536) has expressed it, that "it might be possible to produce, by proper breeding, varieties of clover with a special colour of seed.."

The weight of the seed:—In respect to the weight of the seed from individual plants great variations exist, as recorded by *Eriksson* (1. p. 25) *Malte* (1. pp. 531-532) *Kajanus* (3 pp. 770-772) and *Gmelin* (3. pp. 12-17), the highest 1,000-seed weight being recorded by *Kajanus* with 3.1 gram and the lowest by the writer with 1.18 gram.

Concerning the inherent character of the seed weight, practically nothing is known definitely. The findings of *Gmelin* as a result of studying the 1000-seed weight of numerous plants of various red clover varieties, seem, however, to indicate that the average 1000-seed weight may be considered as a varietal characteristic. Whether the weight is an hereditary character or not, is not clear from the figures available, although certain features in the tables presented by *Kajanus* (1 c.) seem to indicate the existence of an hereditary relation between mother plants and their progeny in respect to the 1000-seed weight.

*The assertion made by *Eastman* (1. p. 93) that "neither the individual head nor the plant bear uniformly coloured seed" is probably due to examination of seeds and heads on widely different stages of development.

(The third and concluding part of this article will appear in the January issue. It will deal with the correlation of characters and will contain an index to the literature quoted throughout the text).

NEW EXPERIMENTAL FARM.

An experimental farm for the South-western section of Ontario has recently been purchased by the Provincial Government. The farm is in the County of Kent bordering on Ridgetown. Experimental work will be conducted in the culture and treatment of tobacco for export as well as experiments in relation to farm fertilizing, the production of seed corn and the treatment of fungous diseases, particularly those attacking the bean crop. A corn specialist will work on the production of seed corn.

Possession of this farm will be procured on March 1, 1922. The size of the farm is 190 acres and the cost to the Government was $205 per acre.

A meeting of the Central Ontario O. A. C. Alumni Association is being held on Friday November 25th, at Hunts — corner of King & Bloor, Toronto. Wm. Chisholm (O. A. C. '16), is Secretary of the Association. President Reynolds will attend the meeting.

Concrete for Permanence

*J. M. SMITH, Professor of Agricultural Engineering, University of Alberta.

Concrete is now used in so many different ways about the farm that everyone connected with agriculture should study its possibilities and learn how to make use of this valuable building material.

This article is not in any way original. It does not outline any specific details regarding the mixing and placing of concrete. It gives some references which can easily be procured and consulted by those who wish to learn something of the use and abuse of the ingredients that go into a concrete mixture. This information should be on file and passed on to those wishing to make practical use of it on the farm.

Ramsower in his book "Equipment for the Farm and Farmstead," outlines in a very concise and clear way some facts concerning concrete:

"Cement is the foundation of all concrete work. There are two kinds to be found upon the market—natural cement and Portland cement.

"Natural cement is made from a rock containing varying quantities of lime and clay. The rock is first ground into fine particles and then burned. The resulting clinker is then reground into a very fine powder known as natural cement. Inasmuch as the rocks from which natural cement is made vary greatly in their composition, the cement varies in its quality. Natural cement, although it begins its initial set more quickly than Portland cement, never attains the ultimate strength that the latter does. It is somewhat cheaper in first cost, but Portland cement should be given the preference for all kinds of concrete work.

"Portland Cement takes its name from the Portland rocks in England, from which it was first made, in 1829. In the United States it was first manufactured in 1870, at Copley, Pennsylvania. Its use has increased so rapidly that now the output amounts to about 100,000,000 bbls. per year.

"Portland cement is made from an artificial mixture of comparatively pure limestone or chalk, and clay or shale, the active ingredients being lime, silica, and alumina. The raw materials are first mixed in the proper proportions and ground to a rather fine powder. The mixture is then fed into large rotary kilns and heated to an extremely high temperature, the powder partially fusing and forming clinkers. These clinkers are then ground into a very fine powder known as Portland cement.

"Inasmuch as the quality and chemical composition of the raw materials, as well as the proportions in which they are mixed, are actually controlled, the resulting cement is of uniform composition. If the bags are exposed to dampness, the cement becomes lumpy. If the lumps are hard, the cement is practically worthless and should not be used. It will keep indefinitely if stored in a dry place. The bags should not be piled on or very near an earth floor.

"**Sand.** In all concrete work some coarse material, or aggregate, is used. A fence post made of pure cement and water would be very strong indeed, but its cost would be prohibitive. The aggregate is used solely to cheapen the cost of the object made. Sand is sometimes called the fine aggregate. That portion of the aggregate, the particles of which are one-quarter inch in diameter or under is called sand. For good concrete work, sand must possess several characteristics. It must be clean; that is to say it must be free from fine clay and from loam."

An extract from a booklet by Harold

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* The member of the Editorial Board for the division of Rural Engineering is very anxious that it should not be a one man department. He will welcome any material that may be sent in for publication. There are a sufficient number of men engaged in Rural Engineering work in Canada to make this a real live department. To accomplish this object it must have their support in a material way.

E. Smith gives some important facts regarding the various ingredients:

"By concrete we mean a mixture of cement, sand, crushed stone, and water, in certain standard proportions. Screened gravel is an excellent substitute for crushed stone. Often pit run gravel is used instead of stone and sand; but it is not recommended as a rule, because the percentages of sand to stone vary widely. An ideal pit run gravel is about 40 per cent sand. Since there is usually too much sand in proportion to the pebbles, cement is saved, and a better concrete is obtained, by screening the sand from the pebbles, and then re-mixing them in correct proportions. All pebbles larger than one and one-fourth inches in diameter are usually discarded; all material less than one-fourth inch is considered sand. When the materials are mixed together, the resulting mixture is poured into forms and allowed to harden into the desired shape.

"The sand used in concrete should be clean and free from clay and other foreign material. One may obtain some idea of its cleanliness by placing it in the palm of one hand and rubbing it with the fingers of the other. If the sand is dirty, it will discolor the palm. To test sand, fill a fruit jar with it to the depth of four inches. Add water until it is within one inch of the top. Shake well and allow to settle. If the layer of mud on top of the sand is one-half inch in thickness, the sand should not be used until it is washed. Preference should be given to sand containing a mixture of coarse and fine grains. Extremely fine sand can be used alone, but it makes a weaker mortar than either coarse sand alone or a mixture of coarse and fine sand. In size of grain, sand should grade from one-fourth inch in diameter down. If a large quantity of fine sand is convenient, get a coarse sand and mix the two together in equal parts. This mixture will produce satisfactory results, and at the same time will make a saving in the quantity of cement necessary. The cement must be kept dry until used. Wet cement will set and is then worthless for use in concrete.

"For top dressing and wearing surfaces, where a smooth surface is desired, a mixture of cement, screened sand and water is placed on top of the coarser concrete. For convenience sake, however, this aggregate is called cement mortar, the term concrete being left to apply to the coarser aggregate.

"*Proportions.* The proportioning of the various ingredients in concrete varies with the character of the work. However, there is one foundation principle underlying all formulae for making concrete, viz.: There must be enough sand to completely fill the spaces between the pieces of stone and enough cement to coat both stone and sand, and to fill a large proportion of all remaining spaces.

"Accordingly the sand and stone should be proportioned to form a solid mass without air-spaces. For a small job, fix the proportion of cement to sand conservatively, so as to be certain of ample strength in the concrete; and then use twice as much gravel or broken stone as sand. This farmula is sufficiently accurate for ordinary requirements. The amount of the water used will vary with every condition of the work and must be estimated separately for each class of work, as discussed later.

"As a rough guide, to determine the quantity of cement advisable in various classes of work, we may take four proportions which differ from each other simply in the relative quantity of cement.

"A rich mixture, for reinforced engine or machine foundations subject to vibration, for reinforced floors, beams and columns, for heavy loading, tanks and other water-tight work, use 1:2:4 mix, that is, one part of cement, 2 parts sand, 4 parts stone or screened gravel.

"A medium mixture, for ordinary machine foundations, thin foundation walls, building walls, arches, ordinary floors, sidewalks, and sewers—proportions 1:2½:5.

"An ordinary mixture, for heavy walls, retaining walls, piers and abutments, which are to be subjected to considerable strain—proportions 1:3:6.

"A lean mixture, for unimportant work in masses where the concrete is subject to plain compressive strain, as in large foundations supporting a stationary load or backing for stone masonry—proportions 1:4:8."

The Canada Cement Company of Mont-

real publishes some excellent material (available by request) on the various uses to which concrete may be put on the farm.

The United States Department of Agriculture in Farmers Bulletins 461 and 481 cover the subject in a very concise and practical way.

The slogan of "Concrete for Permanence" is well chosen, and while we are passing on from the pioneer days we must give the matter of permanent farm buildings our careful consideration.

VITALITY OF POTATO PLANTING STOCK.

Experiments conducted for many years by the Dominion Experimental Farms System, according to the Report of the Dominion Horticulturist obtainable at Ottawa, have proved that seed stock of potatoes that has given a good crop one year would give greatly decreased yields the following year and low yields the succeeding year. The reason for this is still a subject of research, but is is thought to be due to some form of disease. How severe the deterioration may be is indicated by the fact that seed of Irish Cobbler sown in 1918 produced 444 bush. 24 lb. to the acre, good for market, whereas in 1919 the same stock yielded only 50 bush. 36 lb. Of Green Mountain seed sown in 1917 yielded 257 bush. 24 lb. marketable to the acre, in 1918, 154 bush. and in 1919 but 35 bush. 12 lb. In each case the original seed was from the Experimental Farm at Fredericton, N.B. In 1920 new seed from the same place, yielded 449 bush. 12 lb. per acre of Irish Cobbler and of Green Mountain 640 bushels per acre, whereas seed of the latter sown at Ottawa for the previous two years yielded only 74 bush. 48 lb. per acre. Research is being continued with a view, if possible, to ascertain whether the loss in vitality is due to disease or to other causes.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

BUREAU OF RECORDS.

During November about forty percent of the members returned the questionnaires that were sent out early in the month. It is probable that most of the others will be returned before the end of the year, at which time a revised list of members will be printed for general distribution.

In connection with the establishment of this Bureau a membership campaign was launched from the office of President Klinck in Vancouver on November 21st, when the questionnaire, with a covering letter, was sent to every agricultural graduate in Canada who was not already a member of the Society. A generous response is expected during December.

It is more than ever important that every member should promptly notify the General Secretary of any change in position or address or any other information which should be entered in the Bureau. The value of the Bureau lies mainly in its accuracy.

NOTES.

Dr. J. M. Swaine (Cornell) Chief of the Division of Forest Insects in the Dominion Entomological Branch, was elected President of the Professional Institute of Civil Servants at the second annual Convention held recently in Ottawa.

H. M. McElroy (O. A. C. '13) formerly District Agriculturist for the Soldier's Settlement Board in Southern Alberta, has been appointed Superintendent of the Indistrial Farm at Fort William, under the Ontario Department of Agriculture.

E. R. Bewell (Manitoba '14) has given up his position with the Soldier's Settlement Board at Dauphin, Man. His present address is 1038 Oliphant Ave., Victoria, B.C.

The present home address of A. Mcclaren (O. A. C. '09) is Box 1108 Georgetown,

Ont. His office address is 152 Bay St., Toronto. His official title is Field Secretary for Community Organization, for the Social Service Council of Ontario.

T. H. Jones (O. A. C. '19) formerly in the employ of Douglas and Roy, seed merchants of Brantford, Ontario, is now with the B. C. Department of Agriculture at Penticton.

L. G. Heimpel (O. A. C. '18) is in charge of the manual training department at Macdonald College. Mr. Heimpel has been in the service of the Ontario Department of Agriculture for the past six years —four years in drainage extension work and lecturing on farm power and machinery; one year as farm manager at the Ontario Agricultural College; and, in 1920, in charge of farm engineering at the Agricultural School, Kemptville, Ont.

R. Summerby (Macdonald '11) returned to Macdonald College at the end of September, having completed at Cornell University, his post-graduate studies in plant breeding. He was awarded the M. S. A. degree. He has resumed his duties at Macdonald as Professor of Cereal Husbandry.

EASTERN ONTARIO BRANCH.

The first meeting of this local was held at the University Club, Ottawa, on the evening of November 8th when Dr. J. H. Grisdale gave an address on "The Development of Canadian Agriculture". About thirty members were present. An effort will be made to have Dr. Grisdale's address prepared for publication in *Scientific Agriculture.*

At the close of the meeting, during a period of informal discussion, it was suggested that it might be desirable for the programme committee to arrange for one or more debates during the winter upon questions concerning which there was some difference of opinion. Many matters of vital importance to agriculture could be thoroughly discussed, and perhaps a unanimity of opinion reached. This is a suggestion that might well be considered by other branches of the Society.

BRITISH COLUMBIA BRANCH.

The General Secretary has received from the Secretary of the B. C. Local, notice of a meeting to be held in Vancouver on November 18th. The proceedings of the Winnipeg Convention were to be furnished by Messrs. Barss and Hicks — the B. C. delegates.

The programme also includes addresses by President Klinck on "Some Aspects of Agriculture in Europe", and by Professor P. A. Boving on "Recent Advances in Scandinavian Agriculture."

A detailed report of this meeting has not yet been received.

MANITOBA BRANCH.

The second regular meeting was held on November 4th. This meeting took the form of a dinner at the St. Charles Hotel, Winnipeg, followed by a business session. Mr. N. C. MacKay of the Provincial Department of Agriculture, was appointed Vice-President of the Branch in place of Dr. Bisby, who is now in England.

A committee composed of President John Bracken, A. D. Campbell and J. H. Ellis was appointed to act, with the local executive, in arranging a winter programme and in promoting the general welfare of the Branch.

Dr. Alfred Savage, recently appointed to the staff of the Manitoba Agricultural College, gave an address on "Contagious Abortion."

About twenty members attended the meeting.

APPLICATIONS FOR MEMBERSHIP.

W. C. Blackwood, (Toronto 1910 B.S.A.) O.A.C. Guelph.

P. M. Daly, (McGill 1921 B.S.A.) Montreal, P.Q.

W. J. Fairweather, O.A.C. Guelph, (Associate Member).

L. G. Heimpel, (Toronto 1918, B.S.A.), Macdonald College, P.Q.

Norman James, (Toronto 1918, B.S.A.), Agricultural College, Winnipeg.

H. Leblanc (Laval 1919 B.S.A.), Lennoxville, P.Q.

A. Mathieu, (Laval 1916, B.S.A.), Dept. of Agriculture, Quebec.

P. C. Powys, S.S.B., Winnipeg.

E. E. Reilly (Toronto 1916, B.S.A.) O.A.C. Guelph.

J. Thiffault (Laval 1921 B.S.A.) St. Stanislas, P.Q.

G. Toupin, (Laval 1919, B.S.A.) Agricultural Institute, Latrappe, P.Q.

The present membership in the Society is 609.

Les Emplois de l'Aluminium en Laiteries

Par M. E. DROUILLY

Directeur du Département de l'Aluminium à la Société des Tréfileries et Laminoirs du Hâvre.

Le *côté mécanique* des emplois de l'aluminium en laiterie est de première importance. Quand on doit utiliser un récipient d'une certaine résistance mécanique, la première chose à faire est de calculer l'épaisseur qu'il faut donner à l'aluminium pour qu'il réponde à cette résistance. Encore faut-il ici marquer une différence bien nette entre les récipients qui ne sont destinés à servir qu'une seule fois, telles les boîtes utilisées pour le lait concentré, et ceux qui doivent faire un service journalier. Parmi ces derniers, nous devrons même distinguer, en laiterie, entre les ustensiles destinés aux transports, qui seront de ce fait l'objet de cahots, de heurts violents, de manipulations souvent brutales, et ceux qui, appartenant à la laiterie et n'en sortant pas, sont de ce fait moins exposés aux chocs vigoureux (1).

Le pot laitier. — Parmi les ustensiles de laiterie, le pot est celui qui est le plus employé. C'est son étude que nous allons aborder.

L'aluminium, comme tous les métaux, rencontre devant lui, en laiterie, deux terribles adversaires:

a) *La brutalité.*
b) *La malpropreté.*

a) *La brutalité* est une habitude avec laquelle il faut absolument compter; elle est dans la nature humaine. Nous nous inclinons devant elle et nous ne parlerons donc que des pots qui peuvent être brutalisés. Souhaitons toutefois qu'ils le soient moins

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(1) En ce qui concerne les récipients qui étaient autrefois destinés à ne servir qu'une seule fois, il semble se produire depuis quelque temps une orientation nouvelle qu'il y a lieu d'encourager. Les boîtes en fer blanc étaient aussi minces que possible et leur procédé de fabrication par soudure ou agrafage avec joint étanche de caoutchouc non vulcanisé ne permettait pas, après vidange de leur contenu, de les transformer en articles de ménage. Pour la confiture, le miel et les conserves sucrées, on a déjà substitué l'aluminium au fer blanc dans une large mesure, en employant des boîtes embouties en aluminium, fabriquées sans soudure et sans agrafage, et qui par conséquent sont étanches et vont sur le feu. Au lieu du procédé simple, mais rétrograde, qui consiste à souder le couvercle des boîtes en fer blanc après remplissage (et je ne parle pas ici des empoisonnements causés par les mauvaises soudures) et qui oblige, lorsqu'on ouvre ces boîtes à détruire le couvercle, voire même la boîte, en blessant souvent l'opérateur qui n'a pas sous la main l'instrument approprié pour déchirer le couvercle, on a employé des couvercles à emboitement en aluminium, que l'on peut rendre complètement étanches avec des joints si c'est nécessaire; on réalise alors la fermeture avec des bagues serties, faciles à casser, si bien qu'à l'ouverture on ne détruit ni le couvercle ni la boîte. Comme les fabricants de conserves peuvent acheter ces casseroles d'aluminium aux meilleures conditions possibles, en raison des quantités importantes qui leur sont nécessaires, et qu'ils ne prennent aucun bénéfice sur l'emballage, leurs clients ont ainsi le moyen de se procurer des ustensiles de ménage à bon marché. C'est ainsi qu'on nous a signalé que des boîtes à lait de 1 litre étaient vendues pleines de confitures chez l'épicier à un prix à peine supérieur au prix auquel elles sont vendues vides dans les bazars.

Nous nous attendons à voir bientôt vendre le beurre dans de semblables casseroles, l'huile d'olive dans des boîtes à lait de 5 litres et de 10 litres qui pourront être ensuite utilisées pour le lait.

Nous ne doutons pas également qu'il en pourra être de même pour les laits en poudre, les farines lactées, et même les laits concentrés pour lesquels la timbale d'aluminium semble offrir un mode d'emballage tout indiqué.

que les pots en fer, quoique nous ne l'espérions pas. Au surplus, des expériences des plus dures auxquelles nous avons soumis devant témoins des pots en aluminium nous donnent la plus grande confiance. Des pots de 5 litres remplis d'eau ont été jetés sur un pavé de silex:

1) D'une hauteur de 2 m. 50: cela ne leur a rien fait.

2) D'une hauteur de 7 m. 50: légère bosselure.

3) D'une hauteur de 15 mètres: bosselure très marquée, mais le pot n'a pas été crevé.

Nous avons également vu donner de forts coups de talon sur le corps d'un pot de 20 litres, vide, sans réussir à lui faire plus que des enfoncements locaux d'un millimètre de profondeur; les clous du talon avaient laissé une marque très nette sur l'aluminium, témoignant par là de la violence du coup.

Nous souhaitons, avons-nous dit, que ces pots soient moins brutalisés que les pots en fer, parce que l'effort pour les soulever étant moindre, il est probable que les chocs le seront également. Enfin, ajouterons-nous, bien que l'aluminium n'ait pas besoin pour réussir d'un traitement privilégié de la part des garçons laitiers, nous estimons que ceux-ci ne doivent pas être forcément plus brutaux que les garçons épiciers, qui livrent du vin dans des bouteilles de verre. La brutalité de certaines personnes, en laiterie, n'est souvent qu'un masque pour leur cupidité. En même temps qu'un objet de transport, le pot laitier est une mesure, et si un pot en fer de 20 litres servant tous les jours au ramassage, arrive, sous l'influence de bosselures déterminées volontairement, nous sommes-nous laissé dire, à ne plus contenir que 49 litres¾, cela fait 50 à 60 litres que ce pot rapporte par an à celui qui l'a bosselé. Ce sont des moeurs qu'il n'est pas indispensable de tolérer avec les pots en aluminium, car il suffit d'avoir une enclume ayant la forme extérieure du pot pour pouvoir remettre aisément ceux-ci en forme, en les frappant intérieurement avec un marteau de bois dur ou même avec un marteau planeur en acier. Ceci ne pourrait pas se faire avec un pot étamé sans enlever l'étain dont le fer est recouvert et sans provoquer ultérieurement et très vite la formation d'un dépôt de rouille à cet endroit.

Avec l'aluminium, il n'y a pas de couche superficielle que l'on risque de détruire, et si on demande aux pots laitiers de ne pas pouvoir être bosselés par les chocs dus à une manutention ordinaire, on devra aussi avoir soin de les débosseler toutes les fois qu'une bosse aura pu se produire accidentellement ou volontairement.

Si l'accident est provoqué par une pointe et fait un trou, il est facile de réparer par un débosselage suivi d'un point de soudure autogène. Si l'accident compromet tout à fait la destination économique du pot, celui-ci aura encore une valeur pour la refonte, et les fabricants donnent un poids de poterie neuve en échange d'un poids quatre fois plus fort de pots usagés et incomplets qui leur sont rendus.

La brutalité toujours à envisager dans les manutentions a donc amené à étudier quelle était l'épaisseur qu'il fallait donner au pot laitier en aluminium. Des expériences ont été faites simultanément dans plusieurs pays et, pendant la guerre, c'est au Danemark, pays où les industriels n'avaient pas leur attention retenue par d'autres fabrications plus urgentes qu'elles ont pu être poursuivies avec le plus de méthode.

Les premiers pots étaient en aluminium mince fretté par plusieurs cercles en acier; ensuite, on a fait des pots à double paroi, la paroi intérieure étant en aluminium et la paroi extérieure en tôle d'acier, mais très vite on en est venu à employer l'aluminium seul, en partant d'une disque en tôle de ce métal *suffisamment épais pour avoir une résistance au moins égale à celle des pots en fer étamé dont on avait l'habitude de se servir.*

Ces derniers pots ont donné d'excellents résultats en s'arrêtant à une épaisseur de tôle de 3 millimètres: c'est aussi cette épaisseur qui a été choisie par les fabricants français. Les fabricants danois possèdent à l'heure actuelle des références sérieuses sur la façon dont leur poterie a résisté à l'usage journalier pendant quatre années, mais chacun aimant à avoir sur la matière une expérience personnelle, les fabricants français ont mis gratuitement à l'essai un certain nombre de pots dans diverses régions: ils se mettent à la disposition de toutes les personnes que la question intéresse pour leur fournir même un seul pot, dont l'envoi peut facilement être

fait par colis postal, puisqu'il ne pèse que 4½ kilog.

b) Contre la *malpropreté*, il n'y a pas non plus à espérer qu'un changement radical puisse être obtenu du jour au lendemain, bien que l'on puisse prévoir qu'avec le temps il sera possible de mieux s'éduquer soi-même, ce qui permettra ensuite de mieux éduquer le personnel.

Certains auteurs ont indiqué la nécessité absolue qu'il y avait pour les personnes qui ramassent le lait à remettre elles-mêmes aux producteurs des pots parfaitement nettoyés et séchés. *Il faut donc fabriquer des pots dont la surface intérieure soit parfaitement lisse,* dont tous les angles soit arrondis, et dont les pentes soient calculées de façon à permettre l'écoulement des eaux de lavage en plaçant les pots retournés sur des claies d'égouttage.

Ce sont là des conditions qu'il est difficile de réaliser complètement toutes les fois que l'on est obligé de faire appel au rivetage ou à la soudure. Or, *l'aluminium est un métal qui se prête parfaitement à épouser les formes les plus diverses sans avoir recours à la soudure.* Nous donnons la coupe des opérations sucessives par lesquelles passe la fabrication d'un pot laitier de 20 litres dans les usines du Hâvre.

Les feuilles laminées à 3 m.m. d'épaisseur, sont découpées en disques du diamètre nécessaire, puis recuites; elles sont alors embouties et étirées sur des presses puisantes qui leur donnent la forme d'une marmite cylindrique de 26 centimètre de diamètre et de 55 centimètres de hauteur. Les poinçons d'étirage étant légèrement coniques pour permettre de déchausser plus facilement la pièce qui vient d'être étirée, l'épaisseur de ce produit embouti est légèrement plus faible dans la partie ouverte que l'épaisseur du disque qui a servi de point de départ.

Par des forcements à la presse hydraulique de cette partie ouverte dans des matrices successives ayant la forme d'entonnoirs coniques terminés par des cylindres d'un diamètre de plus en plus faible on arrive, à la suite d'un certain nombre d'opérations, à donner au pot la forme parfaitement cylindrique. C'est ici que l'on voit d'une façon remarquable combien l'aluminium est un métal qui, peut-on dire, a *bon caractère* et combien les praticiens qui savent le manipuler peuvent le pétrir à leur gré. L'épaisseur initiale étant 3 millimètres, les bords du cylindre embouti n'avaient plus que 2.5 milimètres; l'épaisseur du collier, après les diverses opérations de retreint indiquées ci-dessus, est cependant redevenue à nouveau 3 millimètres au minimum.

Il faut alors placer les frettes, qui sont également embouties dans des tôles de 3 millimètres d'épaisseur et qui peuvent être faites dans un alliage d'aluminium à la fois léger et très résistant, car comme elles n'entrent pas en contact avec le lait, il n'est pas indispensable qu'elles soient en aluminium pur.

La frette inférieure est obtenue par l'emboutissage d'un disque en forme de casserole et est transformée à la presse hydraulique. Elle présente alors un disque intérieur qui dans les pots ordinaires est découpé et employé pour fabriquer le couvercle. En ne découpant pas ce disque, le frettage donne un double fond, et en donnant à cette frette une hauteur suffisante, elle permettrait même d'emprisonner entre ces deux fonds en aluminium, un troisième fond en bois contreplaqué, qui amortirait les chocs et empêcherait le bosselage et le perçage du fond dans les manutentions les plus brutales.

En général, le pot est suffisamment protégé par le bourrelet de la frette inférieure et le deuxième et le troisième fonds ne sont pas nécessaires. Au besoin, ce bourrelet peut être fourré au moyen d'une baguette en bois tourné ou en bois toupillé.

La frette est placée pendant quelques secondes dans un bain de plomb maintenu entre 400 et 420 degrés (température du bois fumant), elle reçoit ensuite la fourrure en bois du bourrelet, puis est placée sur le fond de la boîte. En la refroidissant brusquement avec de l'eau, on obtient un serrage énergique de la frette sur la boîte qui suffit à assurer son adhérence sans le secours de la soudure, ni d'aucun rivet.

S'il fallait remplacer cette frette après un long usage, il suffirait de la couper au burin, puis de mettre à chaud une nouvelle frette en opérant exactement comme la première fois.

La frette du milieu, qui est découpée dans la même pièce emboutie que la frette inférieure, est rendue solidaire de la frette du collier par les anses. Les anses sont en tube d'aluminium (ou en alliage résistant

et léger, genre duralumin). On les emplit de sable, de plomb ou de résine pour leur donner à chaud la forme convenable, puis on les vide et on aplatit leurs deux extrémités que l'on fixe fortement sur les deux frettes supérieures au moyen de deux rivets dont la tête fraisée affleure à l'intérieur des frettes.

La frette du collier a une hauteur égale à celle du collier lui-même, de façon à renforcer l'épaisseur de l'ouverture qui atteint ainsi un total de 6 millimètres. Elle porte en creux ou en relief les marques distinctives des laiteries, ce qui évite de créer pour ces marques dans le corps de la boîte, une dépression toujours difficile à nettoyer parfaitement. Cette frette porte également une attache rivée pour la chaîne du couvercle.

Le harnais composé des deux frettes supérieures réunies par les anses, de la chaîne, et du couvercle, est placé à chaud sur la boîte, puis refroidi comme il a été indiqué pour la frette intérieure.

Ensuite on opère le forcement de l'ouverture de la boîte, en introduisant successivement dans cette ouverture, au moyen d'une presse hydraulique, deux cônes en acier de dimension apropriées, dont le premier, qui est le moins oblique, appuie fortement la paroi de la boîte sur sa frette, et dont le second qui a exactement le même cône que le couvercle, n'appuie que sur 15 à 20 millimètres et limite à cette hauteur la surface de frottement de celui-ci. On obtient donc une ouverture qui montre que la frette sur laquelle les anses sont fortement rivés fait partie intégrante de la boîte, sans qu'il y ait soudure, et sans que les rivets apparaissent à l'intérieur (disposition brevetée).

Le couvercle est un embouti conique à bord rabattu dans lequel on loge, avant de le rabattre, un cercle en fil d'aluminium de 14 m.m. de diamètre, il est d'une très grande robustesse et on peut ainsi frapper en tous ses points avec un levier de fer pour obtenir, soit la fermeture, soit l'ouverture du pot. La barette du couvercle est également retenue par ce fil à ses deux extrémités recourbées.

La chaîne est en fil d'aluminium et les maillons sont soudés électriquement.

Il existe une autre forme de couvercle, faite à la demande de certain fromagers qui ne désirent pas de chaîne et veulent des couvercles interchangeables. Le milleur moyen d'assurer cette interchangeabilité en économisant le temps, était de leur donner nettement deux millimètres de jeu et de réaliser l'herméticité du pot par un bracelet de caoutchouc qui doit être comme tout le reste, lavé soigneusement à chaque fois.

Pour fixer le couvercle à la boîte, on a fait venir un rebord extérieur sur le collier et le couvercle est maintenu en place par un collier amovible, à rigole et à charnière, qui emprisonne les bords de la boîte et du couvercle et qui est maintenu à sa position de fermeture par un système d'attache d'une grande simplicité.

En résumé, les caractéristiques du pot en aluminium sont celles-ci:

1) Ce pot (en tenant compte de son échange à quatre vieux pour un neuf lorsqu'il est hors de service) est à peine plus cher à acheter qu'un pot en tôle étamée.

2) Il coûte beaucoup moins cher qu'un pot en fer étamé, si l'on ajoute au prix d'achat de celui-ci, le montant des frais de réétamage auxquels il entraînera pendant sa carrière.

3) Sa carrière est au moins égale à celle d'un pot en fer étamé.

4) Il n'est pas susceptible de rouiller.

5) Il pèse environ 4 kilos ½ contre 7 kilos pour le pot en tôle étamée et l'économie de 2 kilos ½, soit 5 kilos par voyage aller et retour, aura vite remboursé son prix d'achat.

6) Comme il ne peut pas plus rouiller extérieurement qu'intérieurement, il n'y a aucun inconvénient à le mettre dans l'eau chaude ou froide.

7) Par les grandes chaleurs, il suffit de l'entourer d'un paillasson ou d'une enveloppe de feutre ou du jute qu'on arrose pour qu'il forme alcarazas; grâce à la grande conductibilité de l'aluminium, le lait est maintenu à une température assez basse, aussi bien pendant le transport que pendant les expositions au soleil dans les champs.

Pour tous ces avantages, nous souhaitons de voir l'emploi du pot en aluminium se généraliser dans toutes les installations laitières.

La seule polémique digne d'attention qui se soit élevée est relative à la qualité de l'aluminium qui doit être employé pour le pot. L'avis de M. Trillat est que l'on

doit fixer son choix sur la qualité industrielle 98-99 pour cent. En effet, on est certain d'en obtenir à volonté, tandis que la qualité extra-pure est plus chère, plus rare, et aussi moins résistante aux chocs.

La petite quantité de fer contenue dans cet aluminium industriel contribue en effet, à en augmenter la résistance, et si elle apparait sous forme d'un dépôt grisâtre à la suite d'un certain nombre de lavages à la soude, ce dépôt forme une patine qui ne se mélange pas au lait et qui n'a aucune influence sur sa qualité. Il est d'ailleurs facile de l'enlever pendant qu'il est encore humide, à la suite d'un lavage au carbonate de sodium, soit par un brossage énergique, soit par un lavage à l'acide sulfurique très étendue d'eau.

Sur une demande formelle et pour des quantités appréciables, il pourrait être fait des pots dont le vase intérieur serait en aluminium extra pur, qui resterait blanc malgré les lavages alcalins, mais nous ne pensons pas que cela ajouterait quoi que ce soit à la qualité du pot, ni à celle du lait.

Le pot que nous avons décrit et dont la contenance est de 20 litres se fait aussi actuellement en 5 litres et 15 litres, et il se fera d'ici peu en 10 litres, 25 litres et 30 litres.

Le pot de un et deux litres pour la distribution à domicile.

Ce qui suit est l'analyse d'un article de *The Milk Industry*:

"Les journaux politiques, entre autres " *The Times,* agitent la question de la pasteurisation obligatoire et de la vente en " bouteilles également obligatoire. La " vente en bouteilles ne peut pas être rendue obligatoire, fait remarquer l'article " d'une façon générale, tant que l'on ne " sera pas certain de trouver un nombre " de bouteilles suffisant..., etc."

Or, ceci ne serait pas un écueil en France, où la question a été étudiée et mise au point par des industriels qui seraient capables de produire, à bref délai, plus de 100,000 bouteilles de un ou deux litres par semaine si elles leur étaient demandées.

En quoi faut-il faire les bouteilles?

Nous entendions dire, par un de nos grands spécialistes des maladies de l'enfance, qu'il valait mieux donner aux enfants des laits concentrés sucrés, de bonne marque, étendus d'eau et bouillis, que des laits quelconques délivrés sans aucune garantie. Or, la supériorité des bonnes marques de lait concentré sur les laits quelconques vendus sans garantie, tient à ce qu'ils sont préparés avec soin et placés dans des boîtes inviolables. Pourquoi ne pas en faire autant pour le lait naturel, d'une façon courante?

On pouvait songer à l'aluminium pour faire les récipients, mais le prix de l'aluminium était considéré alors comme trop élevé; or, il ne l'est plus aujourd'hui.

Les boîtes de fer blanc mince vont bien pour le lait concentré parce qu'elles ne servent qu'une fois. Mais avec le lait ordinaire, liquide, il faut pasteuriser, tyndalliser ou stériliser et, dans ces conditions, on ne peut songer au fer blanc.

De leur côté, les bouteilles en verre sont lourdes, se cassent et ne se prêtent pas commodément aux opérations de chauffage et de brusque refroidissement qu'exigent une fabrication bien conduite en laiterie.

Nous avons sous les yeux 20 boîtes tronc-coniques de un litre en aluminium qui pèsent ensemble 5 kg. 400, soit 2 kg. de moins que le pot de 20 litres en fer étamé. Leur emploi n'entraînerait donc aucun supplément de transport. Leur manutention, en caisses, pourrait être rendue aussi rapide que celle des pots laitiers, et d'ailleurs, comme le lait mis dans ces boîtes serait comestible pendant plusieurs jours avec une pasteurisation bien faite, et même pendant plusieurs mois s'il était stérilisé, il ne serait plus besoin d'utiliser les transports par grande vitesse et l'on pourrait attendre, pour en faire l'expédition, d'en avoir un wagon complet que l'on acheminerait sur les villes par petite vitesse.

C'est donc en fait une réduction des frais de transport par voie de fer qui pourrait être obtenue par l'adoption de ces boîtes qui permettraient, de plus, de faire l'approvisionnement des grandes villes au moyen de lait prélevé dans les campagnes les plus reculées et les plus mal desservies au point de vue des transports.

La boîte de un litre que nous avons sous les yeux est emboutie et rétreinte dans des disques d'aluminium découpés dans des tôles de 1 m. 5 d'épaisseur. Elle est conique, à angles arrondis, et étant faite sans soudure ni rivet, sa surface intérieure est parfaitement lisse, Une large ouverture en permet le nettoyage facile. Elle porte une anse, supportée par deux rivets fixés à un collier par le même procédé breveté

que le collier de la boîte de 20 litres. Le bord de la boîte est rabattu et permet l'application d'un couvercle à étage ayant assez de jeu pour être interchangeable, et rendu étanche par un joint plat de caoutchouc (pur Para, sans soufre). La fermeture hermétique est obtenue par le sertissage d'une bague analogue aux bagues utilisées pour les bouchages métalliques des eaux minérales et qui s'enlève avec la plus grande facilité au moment de l'emploi.

Ces bouteilles vont sur le feu, aussi bien qu'au bain-marie, et permettent d'éviter tout transvasement depuis le filtrage du lait consécutif à la traite jusqu'au moment où il est apporté chaud sur la table du consommateur.

Les bouteilles sont fermées hermétiquement après remplissage et les opérations de pasteurisation, de tyndallisation ou de stérilisation, ont ainsi lieu en vase clos, en conservant tous les gaz du lait. Ces opérations peuvent se faire dans les plus petites installations comme dans les plus grandes, par un simple chauffage dans des bains-marie appropriés.

Sous l'influence de la dilatation du liquide et des gaz contenus à l'intérieur de la boîte, les deux fonds plans, qui résistent moins bien à la pression que la partie conique de la boîte, s'incurvent vers l'extérieur et, la pression atmosphérique ne les ramenant pas à leur forme primitive, il se crée à l'intérieur de la boîte une dépression qui appuie fortement le couvercle; l'ouverture du pot est ainsi rendue impossible sans opérer une rentrée d'air. On emploie pour cela des joints de caoutchouc qui débordent l'extérieur de la boîte et du couvercle, tout au moins en un point, et en tirant sur cette partie débordante, on effectue à la fois la rentrée d'air et le décollage du joint qui permet une ouverture aisée du couvercle.

Il suffit de ramener les fonds à avoir la courbe contraire pour que la boîte, une fois nettoyée, soit prête pour une nouvelle opération, ce qui peut se faire automatiquement par un simple dispositif de la machine à sertir les bagues. Les pliages n'ayant jamais lieu exactement au même endroit, ce mouvement de soufflet des fonds peut avoir lieu des miliers de fois sans détériorer la boîte ni son couvercle.

En employant l'aluminium à la confection des bagues de sertissage qui sont remplacées à chaque fois, et en rendant celles-ci au fournisseur qui les utilise en les refondant, le prix de revient de la fermeture des boîtes de un et deux litres est d'environ 10 centimes, y compris le joint d'étain ou de caoutchouc pur qui doit être remplacé chaque fois. Cette dépense est faible, en raison de la sécurité qu'elle donne.

Nous avons également sous les yeux des boîtes d'un demi et d'un quart de gallon (2 lit. 500 et 1 lit. 250), qui sont fabriquées pour les besoins du marché anglais.

Le biberon en aluminium. — Enfin, nous parlerons d'un biberon en aluminium, d'une contenance de 150 grammes: son nettoyage est rendu facile par le fait qu'il se sépare en deux parties, réunies par une bague sertie, l'herméticité étant obtenue par l'interposition entre les deux parties d'un joint en caoutchouc pur ou mieux en étain pur; son prix est modique (inférieur à 1 franc) et il peut être utilisé comme le pot de un litre décrit ci-dessus, non seulement pour les enfants, mais encore pour toute personne qui n'ayant besoin que de 150 grammes de lait à un moment donné, ne voudrait pas entamer une boîte de un litre.

Si l'on pense que la tyndallisation et la stérilisation permettront de conserver pendant plusieurs mois le lait contenu dans ces petits pots, on pourra ainsi emporter en voyage un aliment que la simple inspection de la fermeture, rigoureusement hermétique, vous indiquera comme bon. On conseillera néanmoins aux mamans de goûter ce lait avant de le donner aux enfants, comme elles le font d'ailleurs avec des bouteilles en verre au travers desquelles on voit cependant le liquide.

Nous nous sommes particulièrement étendu sur les divers pots, dont l'examen vient d'être fait, parce qu'étant des articles de grande consommation, ils peuvent être fabriqués en grande série et que l'industrie peut, par conséquent, les livrer aux conditions les meilleures; mais, en dehors des pots, nous voyons pour l'aluminium les emplois les plus larges en laiterie. Mesures, seaux, bacs, récipients pour maturation de la crême, etc., peuvent être faits en aluminium.

Le développement qu'a acquis son emploi dans les industries de fermentation et spécialement dans la brasserie, a amené à

construire des laminoirs spéciaux pour le travail de ce métal et l'on trouve aujourd'hui des feuilles laminées dont les dimensions et les épaisseurs permettent, en ce qui concerne les bacs, de faire exécuter toutes les tailles voulues; la grande dimension des tôles que l'on peut obtenir et la facilité de l'emboutissage permettront de réduire ua minimum le nombre des soudures qui seront nécessaires pour l'établissement de ces bacs, soudures qui sont toujours coûteuses en raison du fait qu'il faut les lisser avec le plus grand soin.

Nous n'avons d'ailleurs pas épuisé la question et nous pensons y revenir lorsque l'on aura industrialisé l'emploi des recouvrements de l'aluminium, en particulier par les bakélites et les laques de Chine qui semblent susceptibles de faire complètement corps avec les produits emboutis, au point de se plier avec eux lorsque ceux-ci reçoivent des chocs.

Mais, en nous en tenant simplement pour le moment à ceux des articles pour lesquels l'emploi ne soulève aucune discussion, nous pensons avoir pour notre métal national une ère d'emploi nouveaux dont la laiterie pourra profiter dans la plus large mesure.

L,Agriculture dans le Comté de Témiscouata

ROGER GAGNON, B.S.A. Agronome de district.

Le comté de Témiscouata est situé sur la rive sud du St-Laurent quoi qu'en disent certains amateurs de géographie qui l'ont souvent placé sur la rive nord. Il se trouve enclavé entre les comtés de Kamouraska au sud-ouest et de Rimouski au nord-est. Par le Sud et l'Est, il confine au Maine et au Nouveau-Brunswick. Le fleuve le borne au nord.

Eloigné de Québec de quelque cent vingt milles, il y est cependant relié par le chemin de fer National qui le traverse dans la direction ouest nord-est en longeant le littoral du fleuve. Une autre ligne du réseau National, le Transcontinental, fournit, avec le chemin de fer Témiscouata, un lieu entre les différents points du comté et les centres industriels et commerciaux.

Sa superficie est de 1,155,560 acres. Environ 75 pour cent de cette étendue peut constituer de bons sols agricoles. Le reste est occupé par les montagnes, les lacs et les rivières. C'est surtout la partie centrale qui est accidentée; le littoral et la région voisine du Maine sont plutôt plans.

Le sol présente beaucoup de diversité. Des vingt-huit paroisses, aucune ne possède un sol analogue. Dans la partie nord-est du comté, à côté de sols plutôt lourds, se rencontrent de vastes régions sablonneuses. La culture de patates s'y fait en grand. La nature du sol et le voisinage du fleuve en font une région bien appropriée à cette culture. De fait, les brises salines tempèrent les grandes chaleurs de l'été et apportent aux plantes l'humidité dont elles ont besoin. De plus, le fleuve dépose sur la rive de quantités énormes de poissons et d'herbes marines. Ces débris sont utilisés comme engrais et contribuent, pour une large part, à faire de cette région une des plus fortes productrices de patates.

Quant à la partie sud-est du comté, elle constitue la région de colonisation. On y trouve à peu près toutes les essences forestières. Le sol de nature sablo-argileuse se prête bien au défrichement et à la culture. Aussi, dirige-t-on, avec des efforts constants, les colons vers cette partie du comté qui devient vite une section agricole.

L'agriculture, cependant, dans le comté, ne s'est pas développée comme on aurait pu s'y attendre. Ainsi que dans toute autre partie de la province où l'industrie et le commerce du bois ont une certaine importance, l'agriculture n'a progressé que lentement. Il ne lui restait, de fait, que le surplus de main-d'oeuvre laissé par l'industrie du bois. Aussi en a-t-elle souffert. Les hauts prix payés dans les chantiers, dans les scieries, dans les pulperies attiraient la population rurale vers ces centres et de trop rares bras restaient pour cultiver le sol.

Les sociétés agricoles qui groupent ún nombre de membres de plus en plus grand s'efforcent d'améliorer l'état de l'agriculture. En 1918, c'est à peine si le comté fournissait 1,000 livres de trèfle. Le nombre de batteuses se limitait à trois à cette époque. Aujourd'hui, vingt-quatre batteuses sont dispersées dans les différentes paroisses et l'on produit au-delà de 33,000

lbs. de trèfle. En si peu de temps, c'est grand progrès.

L'industrie animale se relève petit à petit à mesure que la science de l'élevage se vulgarise. Les animaux croisés cèdent la place aux animaux de races pures et l'on voit maintenant de bons troupeaux de Leicesters, de Shropshire, de Holstein, de Ayrshire et de Canadiennes, faire excellente figure aux différentes expositions locales et même à celle de Québec.

Depuis l'introduction des races pures dans le comté, l'industrie laitière a pris un nouvel essor. La production laitière s'est élevée à un niveau qu'elle n'avait pas atteint, et permet d'entretenir trente-cinq fabriques.

Il reste encore de grandes étendues de terre à mettre en culture. Durant plusieurs années à venir, les colons trouveront ici de bonnes terres. Depuis quelques décades, on a vu s'ouvrir nombre de nouveaux cantons. Mais il y a place encore pour ériger de belles paroisses. Le développement des chemins de fer et des bonnes routes fait reculer les limites de la forêt.

La mise en opération d'une sage politique agricole permettra à notre population de grandir davantage pour exploiter les richesses que le sol cache encore dans son sein.

A L'ASSEMBLEE DE QUEBEC

Les deux sections françaises de la Société des agronomes canadiens ont tenu, le 12 d'octobre, à Québec, une importante assemblée.

On a définitivement réglé l'affaire Grégoire. L'attitude prise par la Société dans cette circonstance a été regardée comme une garantie pour l'avenir. Les représentants du peuple ne susciteront plus d'ennuis dans le genre de celle-là.

Le Comité de l'Enseignement Agricole de la Société rapporte progrès. Il présentera bientôt un plan pour l'établissement d'un système complet d'enseignement agricole dans la province de Québec. Il utilisera les notes que les enquêteurs du Ministère de l'Agriculture ont recueilli dans les différentes provinces du Canada.

:: EDITORIAL ::

When the Canadian Society of Technical Agriculturists assumed the ownership of *Scientific Agriculture* in July last, it became apparent at once that particular caution would have to be exercised in soliciting and accepting advertisements. Because the magazine was the organ of professional men and since it was owned, edited and published by professional men, it was considered that no announcement should be published which could not be endorsed by professional men. It was highly desirable, if not absolutely necessary, that the publication should be self-supporting, but the adoption of a policy of restrictive or selective advertising was regarded as vital, and any other policy which would perhaps more quickly produce a satisfactory revenue could not be considered.

For these reasons the advertising policy was made a part of the editorial policy, the opinion being general that in a publication issued in the interests of agricultural research, education, extension—in short, better agricultural methods—the advertising pages would and should play an important part. If the advertising pages of the magazine could be developed into a reliable reference medium for the professional worker, then the Society would have gone far towards accomplishing a very important work. Under the proposed policy, the amount of advertising space used by a firm was a secondary consideration, the main one being that of representation in the magazine.

Some difficulties have already been encountered, some have been overcome and some have yet to be faced. Firms and advertising agencies have been skeptical as to the stability or permanence of such a policy. Some advertisers are interested solely in volume of circulation and do not regard the class of circulation or the influence of readers as being important. Industrial depression has prevented many reputable firms from giving any consideration to the matter of advertising. Practically all of these difficulties are temporary and are steadily being overcome. Several instances in which advertisements have been rejected as unsuitable are helping to emphasize the fact that the policy is actually being maintained. The influence of the professional man upon the buying power of his constituency is becoming appreciated. Business conditions are improving. There is now a definite indication that the policy adopted by the Society is gaining in favour.

In certain fields of agricultural manufacture a selective advertising policy is one to which strict adherence involves considerable responsibility. Every range of a large industry must be covered—building materials, machinery, dairy equipment, laboratory supplies, seeds, fertilizers, spray materials, stock feeds, text books, etc., etc. To some of these divisions the policy must be more rigidly applied than to others, but ultimately it should be possible to develop a very valuable reference medium for every branch of agricultural equipment.

Up to the present time progress towards the desired goal has been slow, for reasons already made plain. Probably no more unfavorable period could have been chosen for launching a new publication than the past year. And to handicap a new magazine with a restrictive advertising policy was an additional barrier which, at the outset, appeared difficult to surmount. But there was no other course to follow. An offical organ is vital to the Society but it must also be creditable to the Society and to professional agriculture. Could it be considered creditable if it included advertisements of impure seeds, condemned fertilizers, questionable stock "invigorators" and other commodities which should never find a place on a modern Canadian farm?

Now that the selective advertising policy is becoming better known and results are steadily appearing, further developments

of that policy may suggest themselves and be put into effect. It has been suggested, for instance, that the advertising revenue from *Scientific Agriculture* should never be allowed to very greatly exceed the cost of publication—in other words, that a reserve of profits should not be built up, if such were at all possible. It is admitted that a certain number of pages of paid advertising are necessary, but whether those pages contain the announcements of twenty, thirty or forty firms should be of no consequence. When it is found necessary to increase the number of advertising pages, the added revenue might be applied to a reduction in advertising rates or to any other purpose suggested by the advertisers and approved by the owners of the magazine. These suggestions point out some of the lines along which further developments may take place. Other suggestions will be appreciated.

It will be some time before the full results of this advertising policy will be felt. A period of "educating the reader" must be passed through as well as the period of convincing the prospective advertiser. Most of the readers of *Scientific Agriculture* are professional men, leaders in their own communities, who are constantly being consulted as to the best machinery, fertilizers, feeds, etc. Once these men, who are owners of *Scientific Agriculture*, appreciate the merits of their own policy, its importance as an advertising proposition rapidly increases. So that ultimately a measure of co-operation between highly reputable firms on the one hand and the members of the Society on the other will be the natural result.

The close of 1921 finds the Society in a thriving condition. Not only has it brought its official organ through a period of serious depression, but it has established it on what now appears to be a very firm basis. During the development of the magazine, the Society has made steady progress in other directions, and has received prominent recognition. The membership list has grown from 557 to 625 during the past six months, and is increasing steadily at the time of writing. It is quite reasonable to suppose that there will be seven hundred members by June next, a figure which a year ago would certainly have been considered impossible of attainment. The members have shown most encouraging interest in their own local branches, and enthusiastic meetings are being held frequently in all provinces of the Dominion. During the present month an official communication from the American Association for the Advancement of Science states that its Executive Committee has admitted the C.S.T.A. as an Associated Society, and as such it will take part in the programme of the American Association at the Toronto meetings this month.

Just one year ago, at a meeting in Saskatoon on December 31st, the provincial organization work of the C.S.T.A. was completed, and there was no province in the Dominion without at least one local branch. At that time it was thought that the Society had made splendid progress during 1920 and that the year 1921 should be entered upon with enthusiasm and hopefulness. Thanks to the enthusiasm that has reached every individual member through the branches organized in 1920, the year 1921 has been even more successful.

What the possibilities are for the future it is difficult to foretell. This much is certain: there must be no loss of enthusiasm or interest or co-operation. Those three tremendous assets belong to every member. The development of the C.S.T.A. is far from complete, but it will be made more rapid by Dominion-wide effort than by any other influence. In extending a Christmas and New Year greeting to our members and readers, we can wish no more than this—prosperity, sustained individual effort and co-operation.

The article on page 153 of the present issue on "Poultry Breeding at the University of B.C." deals with Wyandottes and Leghorns. It will be followed, in the next issue, by the results obtained with Rocks and Reds.

Lightning Rods

W. H. Day*, Secretary and Manager, Shinn Manufacturing Co. of Canada, Ltd.

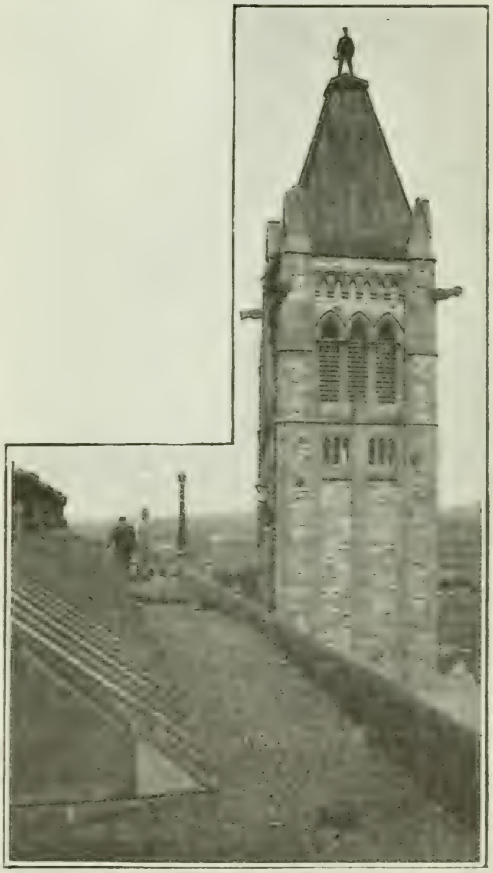
No article of merit and usefulness has suffered more from unscrupulous methods than has the Lightning Rod. Perhaps none is entitled to greater confidence. Certainly none has a more solid foundation in science.

Protection against lightning is an electrical problem. Few of the stories of science are of more absorbing interest than that of Franklin's discovery that lightning is a discharge of electricity and may be rendered innocuous by the lightning rod.

For many centuries development in electricity was very slow. Static charges produced by friction were first discovered by Thales, 640 B. C. in a piece of amber, Greek **electron,** hence the word electricity. They were mentioned again by Pliny in 70 A. D. but not till Dr. Gilbert's time, 1600 A. D., was any extended and concentrated investigation devoted to the subject. This English physician and physicist discovered that not only amber but all solids, if properly manipulated can be electrified by friction. Forty years later Otto von Guericke of Magdeburg invented the first "electrical machine", consisting of a sulphur ball mounted on an axis and turned by a crank, the friction being applied by the hands rubbing on the ball. Considerable charges could be produced by it. All the leading scientists of the day experimented with it and improved forms, and at least two suspected the identity of the electric spark and the lightning discharge, viz, Francis Hauksbee mildly in 1709 and Stephen Gray emphatically in 1720. Twenty five years later the Leyden jar was discovered by which large charges could be accumulated and violent flashes produced. This was soon incorporated in the electric machine. Experimenting spread even to the "New World" where on July 4th, 1752, Franklin, by means of a kite sent up in a thunderstorm, proved directly and absolutely that lightning is produced by a discharge of electricity.

* Formerly Professor of Physics at the Ontario Agricultural College.

Franklin's scientific knowledge was not gained in University but by his own private study and was marked by his outstanding characteristic of being practical. Consequently, the discovery of the relation between lightning and electricity led at once to his applying three of the laws of this science in an endeavour to control lightning. They are :



Steeple-jacks at work protecting Northwest Tower, New Centre Block, Parliament Buildings, Ottawa.

1. Electricity is transmitted most easily along metals.
2. Electricity leaks off points (discovered by Franklin).
3. When two opposite charges of electricity exist they attract each other if

strong enough to break through the intervening space, a violent spark occurs, but if allowed to leak off points, these charges neutralize quietly without a spark.

Accordingly in the summer of 1752, within a few weeks of his great discovery, he erected a set of lightning rods on his own house, constructed of iron, with a sharp point at the top and the bottom extending five feet into the ground.

Attaching cable to ventilating shaft, New Centre Block, Parliament Buildings, Ottawa.

To the lightning rod he attached a device that was connected with two bells which rang when a current was passing along the rod. Some of the observations are best told in Franklin's own words : "I found the bells rang sometimes when there was no lightning or thunder, but only a dark cloud over the rod; that sometimes, after a flash of lightning, they would suddenly stop, and at other times when they had not rung before, they would, after a flash, suddenly begin to ring; that the electricity was sometimes very faint, so that when a small spark was obtained, another could not be got for some time after. At other times, the sparks would follow extremely quickly; and once I had a continual stream from bell to bell, the size of a crow-quill".

Europe was prepared for the news of Franklin's discovery. In 1751 a manuscript entitled "New Experiments and Observations in Electricity, made at Philadelphia, in America", was sent by him to a friend in London, who realizing the importance of the paper had it printed in pamphlet form. It set forth Franklin's conviction that lightning was an electric discharge. The pamphlet was sent to men of science throughout Europe. One of them, M. Delibard, erected an iron rod 100 feet high on a tower in his garden, and during a thunderstorm on May 10th 1752, nearly two months prior to Franklin's kite experiment, he was rewarded by finding electric sparks given off at the foot of the rod. Three days later this was reported to the Academie des Sciences of Paris, at a special meeting called for the purpose. The experiment was weak in one respect — the observers were inexperienced. The occurrence really took place in M. Delibard's absence and was observed by one of his servants, who summoned the prior of the village, followed by other inhabitants equally inexperienced. Hence, though they all witnessed the display there was some hesitancy on the part of scientists to accept the result as conclusive. But when Franklin's report of his kite experiment arrived, all doubt was swept away and Franklin himself heralded as one of the most noted scientists of the world, in recognition of which he was elected to honorary membership in most of the scientific societies of Europe.

For 150 years the history of the lightning rod was a checkered one. Its first blow was in France, where it was attacked by Abbé Nollet, their most noted electrician, and a man in high favour at the French court. He used his great influence in all quarters, and the clergy generally in France, Italy and other Catholic countries opposed the "heretical rods". In England there was a strong faction against the use of rods. Gradually, however, they gained

headway until many of the prominent public buildings in Europe were protected. Occasionally a building with rods on it was damaged, and the opponents of course seized upon these accidents to bolster up their objections. The supporters, however, studied all cases minutely in an endeavour to perfect the system of protection and thus avoid such occurrences.

In America, where fine buildings were less numerous, development was largely in the direction of rodding rural buildings, and the work was for the most part in the hands of men who knew nothing about electricity or the principles involved in lightning protection; hence the material and installations were often inferior and this led to losses which cast discredit on all rodding whether good or bad, not to mention the lightning rod swindles that were perpetrated. However during the last twenty or twenty five years, a number of lightning rod firms both in Canada and the United States have been standardizing the business, both as to material and workmanship and thus raising the industry to a higher plane. In the midst of this Agricultural colleges began to investigate the efficiency of lightning rods by collecting data as to the comparative damage done by lightning to rodded and unrodded buildings. The Ontario Agricultural College was fortunate in being the first to obtain decisive results, and in publishing its Bulletin 220, which establishes beyond possibility of doubt that good lightning rods properly installed are almost absolute protection against lightning. This conclusion was established through data collected for the College by the Mutual Insurance Companies.

The method of calculating the efficiency may be illustrated from data for 1912, the first year for which the efficiency was determined. In that year out of every 7000 *unrodded* buildings insured by the reporting companies 37 suffered damage by strokes, several being burned completely, and 37 claims were paid. But 7000 *rodded* buildings insured by the same companies suffered only 2 strokes, where at the same rate as the *unrodded ones* 37 would have been expected. To prevent strokes or damage in 35 out of an expectancy of 37 amounts to 94.50 percent. Since then results have been obtained for the years 1913-15, showing that on the average the

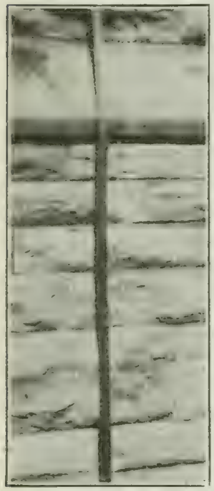
Putting points on copper finials; New Centre Block, Parliament Buildings, Ottawa.

rods prevented 93.3 p. c. of all damages that it was possible for them to prevent. Similar results have since been calculated from available data in many States of the American Union. Hence just as lightning rods were first invented and used in America similarly the first compilation of data establishing their efficiency was also made on this continent. Indeed we are not aware that such compilations have even yet been made in Europe.

Although 6.7 percent of the rodded buildings expected to be struck have actually suffered, yet the damage done has not been so high, for when a rodded building is struck even though the rods and installation be poor the damage is lighter than on an unrodded one. If we

calculate the efficiency by the dollars saved the average comes to 97.2 instead of 93.3, a difference of 3.9 percent, which is a shade more than half of the 6.7.

The reason why the rods as in general use permit damage in 6.7 p. c. of the possible cases has been the subject of much thought and research, even before this exact figure was known. From 1885 onward to 1895, European scientists devoted considerable time to the study of the cases where damage occurred to rodded structures. Among the foremost of these was Sir Oliver Lodge, whose experiments and



Left: Down cable on Tower of New Parliament Building.
Right: Closer view showing special bracket fastening cable to Tower.

writings on the subject, extended over some five or six years.

When the lightning rod was invented the relative conductivity of different metals was still unknown, and it was believed that any metal would be entirely satisfactory, hence on account of its cheapness and accessibility in suitable form, iron was adopted by the early scientists and erectors. But about 1820 Sir Humphrey Davy, one of the earliest experimenters on electrical conductivity, published his comparative list showing that copper is seven times as good a conductor of steady current as is iron. By this time there had been some failures of iron rods, and by many the poor conductivity of iron was at once seized upon as the cause. Others however still advocated iron and then some copper rods failed, and so there arose a controversy over material, with men of science ranged on either side, a controversy extending even to this day, and which is being slowly decided in the great laboratory of experience under the guidance of new knowledge of the nature of lightning and new electrical phenomena in these later years, and consequently additional laws of electricity applying.

In the early years static electricity, that is electricity existing in the form of stationary "charges" either positive or negative on conducting bodies ,was the only form known. Static induction, of course, was known, that is the production of a new charge by the influence of one already in existence, the induced being of opposite kind to the original.

This accounts for the accumulation of a charge on the earth directly beneath the thunder cloud. It was also realized that when two charges rush together, a "current" is set up in the intervening path whether it be of air or metal, a current identical in properties with that later produced by batteries and generators. Of all these properties the greatest is current induction, discovered by Faraday in 1831. If two wires lie side by side and a current is sent through one, a momentary current is induced in the other in opposite direction to the original, and when the original is stopped, another momentary induction occurs in the secondary wire, this being in opposite direction to the first induction. If the secondary is a closed circuit the impulses will travel completely round it, and if not they bank up, first at one end of the wire and then at the other producing a condition similar to a static charge and favourable to a spark and inviting side flash. Self-induction also comes into play — when a current is first forcing its way through a wire there is a back induction in that same wire and when the current is dying out another self induction, this being in the same direction as the original current. Static induction, current induction in neighboring conductors, and self-induction in the main conductors, as well as the conductivity and durability of the latter, must all be taken into consideration when determining the

cause of failure of lightning rods and the kind of material, type of rod, and system of installation necessary to perfect protection.

The discharge of a static machine, as the electrical machine with its Leyden jars is now universally called, may be either direct or alternating, depending on the resistance of the conductor in relation to the charge. If the resistance is great enough to dissipate the energy in one passage of the current, there will be a single impulse in one direction, but if not then the charge will oscillate back and forth — an alternating current — until the energy is turned into heat. An alternating current builds up high self induction, which although obstructing the current, does not aid in dissipating the energy. However, the self-induction has a tendency to cause the current to side-flash to other conductors in the vicinity, although the resistance of the wire carrying it may be only a small fraction of an ohm. This was clearly proven by Lodge thirty years ago in one of his classic experiments with alternating discharge from Leyden jars. To gain an idea of the relative importance of self-induction and resistance Lodge computed these for various frequencies ranging from 12 million to a quarter of a million per second. "At the higher frequencies self-induction alone counts. At a quarter million vibrations the material just begins to matter, and iron has a trace more impedence than copper". (page 116, Lightning Conductors and Lightning Guards). "Impedence" is a term used to include both resistance and self-induction. Believing the frequency to be a million or more, he therefore fovoured iron.

Today, however, we know that lightning is not alternating but direct, although there may be several discharges in rapid succession along the same path but all in the same direction. This was proven by De Blois in 1913, by means of an oscillograph in measuring actual lightning flashes. No oscillations were found, but rather undirectional discharges, the duration of which ranged from .0002 to .0016 seconds, the average being more than one hundred and fifty times as slow as the quarter million frequency alluded to by Lodge. Hence at the now known duration of lightning discharges, especially the slower ones, resistance is an important factor, and from scientific considerations the lower the resistance of the lightning conductor, the better the results that may be expected. This is borne out in practice. Of the rodded buildings burned by lightning and which have come to the writer's attention during eighteen years' study of the problem, all but two have either been rodded with iron rods or iron centred ones, both of which exceptions were badly installed. Therefore so far as Canadian practice is concerned it may be taken as finally established that copper is the most desirable element for use in protection against lightning.

In this result the question of durability played an important part. Iron rods are short-lived where subject to extreme conditions, often being found corroded off at the ground.

It is sometimes stated that a building imperfectly rodded is in greater danger than if not protected at all. This does not appear to be borne out either by scientific considerations or by the practical data collected at the O. A . C.

Since it is very important that the resistance in the lightning rod circuit should be as low as possible, and since usually the ground resistance is many times as great as that of the conductor itself, it naturally follows that great pains should be taken to sink the cable to permanent moisture and give it as much earth contact as possible. If a water pipe or gas main is near at hand the grounding can usually be materially improved by connecting the cable to the pipe: generally the resistance of water and gas pipe groundings does not exceed 5 to 7 ohms, while resistance between cable (8 to 10 feet) and soil may run from 25-50 ohms in ordinary soils to 100 ohms or more in sandy, gravelly or filled soils.

From the time current induction was discovered by Faraday the practice of connecting to the lightning rod various metallic parts of the structure lying in its vicinity became more general. Lodge set up experiments to study whether this was good practice. While he found it possible even with all neighboring metals connected, to produce sparks from the conductor

under such conditions, yet they were smaller and less violent than if the connections were not made. The preponderance of scientific indications and likewise the results of practice, point to the advisability of having all metals lying near the conductor connected up to the system and under certain conditions also grounded.

Herein lies one of the weak points of all iron rods and of stiff copper rods. It is difficult to make sufficient electrical contact at junctions of stiff cables either with metal objects or with other parts of the cable itself. In a number of cases where lightning rods have failed the conductors at the junctions have been found burned up by the heat generated through resistance at the poor connections.

One other feature remains to be discussed, viz., type of cable. In the early '80's several eminent scientists demonstrated that when a current *starts* through a conductor it begins on the outside and gradually penetrates inward, and it also stops first at the surface. In 1885 Heaveside demonstrated that rapidly alternating currents confine themselves to the surface of conductors—"skin effect," and physicists are pretty generally agreed that in the lightning conductor when struck the same condition prevails because, with the instantaneous duration of the flash, there is not time for the current to penetrate deeply: and that from the rapid rise of the current self-induction must be great. Lodge experimenting with wire vs. tape found that the latter has much less self-induction than the former and that "thin ribbon shows a distinct advantage over round rod." However realizing that thin ribbon was difficult to handle and possibly not durable, he advised making the cables of moderately small wires, in order to secure more surface and thus reduce the self induction with its liability to side flash. This suggestion has been widely adopted. Following along the same line, a flat woven cable has now been developed in which every wire comes to both surfaces and which consequently has about twice as much exposed surface as round cables containing the same amount of material. By official test within the last year the flat cable has been found to have less self-induction, less resistance, and consequently to develop less heat and offer greater capacity than a number of heavier round cables against which it was tested.

An equally important feature of flat cables is that on account of their form they lend themselves to better connections both mechanically and electrically than is possible with round cables, no matter whether those connections be with metallic portions of the structure or between different parts of the cable and equipment. The trend in the future must naturally be toward the more general adoption of this better type of cable.

The O. A. C. data prove that in many cases strokes are actually prevented, but not in all. And Lodge in his experiments showed that it is impossible to prevent them all. Sometimes a cloud charges up gradually and sometimes suddenly. In the former case prevention is possible by permitting the earth charge, or at least part of it, to gradually leak off points and thus quietly make it way to and neutralize that in the cloud, sufficiently to reduce the potential below bursting tension, but in the latter there is not time for leakage to occur and a flash follows, and if toward a building a well installed system of protection will carry it off without damage in nearly all cases.

With science and experience pointing the way in the matters of material, type of cable, handling metallic bodies, designing system for different buildings, and lastly methods of installation, and with the Lightning Rod Act providing Government regulation to insure that the known standards shall be lived up to by all, there is reason to believe the general efficiency of lightning rods henceforth installed in Ontario can be raised to nearly 100 p.c.

SHELTER-BELTS AND SOIL FERTILITY.

A blanket of four or five inches of snow over a prairie farm during winter and until early spring means a large amount of moisture for the soil. The problem is to keep it there and not have it blown away by high winds. This is where shelter belts on the farm prove their value by preventing drifting and thus retaining moisture and fertility.

Poultry Breeding at the University of British Columbia

By E. A. LLOYD and V. S. ASMUNDSON.

A large portion of British Columbia with its mild and even climate is well adapted to poultry raising. Along the Pacific Coast, in the Lower Fraser Valley, and on Vancouver Island, the poultry industry is being developed in an intensive way. It is quite common to find poultry farms in some districts carrying from one to four thousand birds. Many of these farms are so highly specialized that poultry provides over 90 per cent. of the gross revenue, obtained for the most part from the sale of market eggs. The production of a large number of eggs per hen thus becomes the factor of greatest economic importance to the farmer. While the average egg production for the whole province is approximately 120 eggs per hen according to statistics that are available, flock averages of 160 eggs are fairly common. Some commercial flocks are known to produce as high an average as 200 eggs per bird in the pullet year.

Under conditions of such intense egg production, breeding work becomes much more technical in nature and to be ideal should approach an exact science. Very few private individuals can find the time, the labor, or the means for carrying out such breeding projects as the industry requires. Consequently such institutions as the University are expected to do the work.

The Beginning of Breeding Work.

The poultry plant at the University of British Columbia has only been in operation since the Fall of 1918, when a number of pens especially selected from high producing stock in S. C. White Leghorns, White Wyandottes, Barred Plymouth Rocks, and S. C. Rhode Island Reds were introduced. The work accomplished in such a short time with these breeds cannot possibly be of a conclusive nature. Many interesting observations, however, have been made, and some information is available concerning these breeds. While increased egg production is the great objective, the requirements of the American standard of perfection have not been disregarded. Approximately 115 pullets of each of the four breeds is entered from year to year in Canadian Record of Performance which provides an effective check upon using birds with standard disqualifications. Such adherence to standard requirements assists in preserving the identities of the breeds and leads to the more uniform production of a standard commercial commodity. At a time when Canada is building up such a splendid reputation in the quality of her eggs through the Government system of inspection and grading, quality of eggs assumes an importance almost equal to that of numbers. In order to secure standard birds that lay eggs that grade high, some sacrifice of number is necessary. This sacrifice can well be justified by the economic importance of Government grading to the Canadian poultry industry.

White Leghorn Cock No. 527. Not fully moulted on Nov. 10. Sire of five daughters that averaged 234 eggs out of No. 56 hen that laid 190 eggs. Remainder of his pullets averaged 230 eggs, including B. 501 that laid 312 eggs.

The Character of Foundation Stock.

Some 900 females of the different breeds are kept on the University Farm at Point Grey. Each one of these birds is trapnested, and full records are kept of egg numbers, size of egg, quality of egg, broodiness, moulting, etc. Trapnesting is followed by pedigree breeding, pedigree hatching and rearing. Very rigorous selection is carried on at all times for vigor, type and other desirable breed characteristics.

The foundation stock in S. C. White Leghorns consisted of a pen of 10 hens as bred by Professor Dryden at the Oregon Agricultural College, Corvallis. Such famous long distance layers as A27 that laid 240, 222, 202, 155, 168, 139, and 61 eggs in as many successive years, H38N that laid 139, 197, 200, 181, 179, 120 and 80 eggs; E248, one of the first official 300-egg hens; E21, that laid 259, 249, 172 and 215 eggs, all appear quite frequently in the extended pedigrees. The progeny of these hens has been distributed very widely to improve laying flocks in the states to the south of us. Professor Lunn, who founded the department, also secured from O. A. C. two cockerels, Nos. 2671 and 2785, of similar breeding, to furnish good breeding lines.

White Leghorn Hen B. 501 that had laid 317 eggs when photo was taken on November 10. She is two thirds moulted and does not stop laying. A typical long distance producer.

This O. A. C. stock was supplemented by stock from some of the best known B. C. breeders. These birds came from flocks that were noted for high average production and have shown splendid vitality and good production under University tests.

Two years' Tests with Leghorns.

In two years' tests, as conducted up to the present, the breeding work has consisted largely of testing out a large number of pen matings for the purpose of eliminating as quickly as possible the poorer breeders. The standard set for the good breeder includes reasonably high production in the dam herself in the pullet year; later on due credit is given for long distance production. Under British Columbia conditions, the first year mark is set approximately at 200 eggs or better, and 150 eggs or better in at least two succeeding years. Eggs must be of Dominion Government standard size for extras, at least two ounces each in weight, of pure white color, and of strong, smooth, fine shell texture. The dam must prove herself capable of reproducing her kind by giving a considerable number of daughters that lay a high average. Complete records of fertility, hatchability and livability of chicks are kept. Leghorn type, size and vigor are constantly under observation and are emphasized in selection.

Out of the diverse breeding material a few promising breeders have been found. Hen No. 26 is a fair individual of the breed, having laid 226, 185 and 164 eggs that average 2.08 ounces in weight. This hen has produced 10 daughters, 8 of which have laid from 204 to 267 eggs in their pullet year, while two of them have laid 197 and 153 eggs, respectively. This constitutes an average of 216 two-ounce eggs per bird. The eggs of No. 26 are 96.6 per cent fertile and hatch 76 per cent efficiently. The continued reproduction and multiplication of this family seems desirable.

Hen No. 56 laid 169, 175 and 181 eggs weighing 2.07 ounces, in her first three years. This hen produced five daughters that laid 234 eggs average in their pullet years. Fertility and hatchability in this hen in two years testing have been 100 per cent. Such reproductive ability should,

with the increase of this family, prove to be of considerable economic value.

Some sixteen other Leghorn hens have been retained because they have given certain outstanding daughters as well as mediocre ones, and seemed deserving of a more complete progeny test.

Testing Males.

Males Nos. 2671 and 2785 are closely related Oregon White Leghorns. They illustrate the variable prepotency of males of similar blood lines as shown by pedigree. No. 2671 produced 84 daughters that averaged 40.3 eggs in winter production, a record scarcely equal to that of the dams. No. 2785 gave 90 daughters that averaged 69.2 eggs in winter production, a record that was 25 per cent greater than the production of their mothers. Male No. A527, a son of 2785, is outstanding. When mated with hen No. 56, as referred to above, he produced five daughters that averaged 234 eggs, and when mated to three other hens his pullets averaged 230 eggs. Amongst the latter was one daughter from hen No. 65 that has laid 312 eggs up to Nov. 1st last. Practically the only defect in the progeny of this male is that their eggs do not all weigh up to the two-ounce average. The compensating feature is that hen No. 501, the 312-egg performer, lays eggs that average well over the two-ounce standard. She will be mated back to her sire, since the old hen No. 65 is dead. A227, a full brother of A527 from O. A. C. 153, also has given a large number of good daughters that have laid from 200 to 283 eggs. At the same time, when mated with poor hens the progeny has not done so well. This bird does not seem to be as prepotent as his brother, A527. Ordinary producing ability and prepotency seems to depend upon individual matings. It does not seem to be safe to emphasize unduly either males or females in the genetic calculation.

White Wyandottes.

The foundation stock in White Wyandottes came from B. C. breeders who had built up high producing, vigorous flocks by the use of the best pedigreed males obtainable crossed with hens that had been selected carefully for size, type, visible productive characters and vigor. Probably the most promising family is that included in the progeny of hen No. 15. She laid 225, 169 and 152 eggs in her first three years, a fair average for a Wyandotte. Fourteen daughters from her by male 194 laid an average of 219 eggs last year, while the production of her eleven daughters this year by another male was 190. These twenty-five daughters show relatively little broodiness and many are non-broody. The average size of egg is around two ounces, while the fertility and hatchability of eggs shows a uniformly good average.

The progeny of hen No. 8 make another

White Wyandotte Hen No. 8, has given 36 daughters averaging 62.6 eggs in winter production. Seven of her grand daughters averaged 215 eggs. Her progeny lay up to 259 eggs.

promising family. The daughters of this hen have given a uniform production, although not a very high average. They lay a large egg and give good hatchability, averaging around 80 per cent. One of these daughters, A102, laid 255 eggs, and she has two daughters laying 211 and 259 eggs, respectively and a third that showed promise of laying well over the 200 mark when she died. Another group of granddaughters of 8 from hen A163 gave an average of 215 eggs for eight birds, exclusive of one poor producer. Some daughters of No. 8, such as A132, mated to the same male as used with A102 and A163, gave some low producing daughters. Seven daughters of

A132 averaged to lay 185 eggs in their first year and were quite broody. The daughters of 8 were all mated to the same male in 1920. These daughters, 36 in number, averaged 62.6 eggs in winter production as to March 1st, and with the exception of one or two individuals laid eggs that averaged 26 ounces per dozen.

No definite results have been obtained in the tests that have been made of White Wyandotte males, all males so far tested having given fair production in their daughters. In U. B. C. White Wyandottes it would appear from tests so far conducted that the females were fully as prepotent if not more powerful than the males in the transmission of fecundity. This is more marked in the case of Wyandottes than with the White Leghorns.

. . . . Observations About Leghorns.

The White Leghorn hen of B. C. is a large vigorous bird, averaging well up to four pounds in weight. Many of her eggs will grade "Specials" (25 ounces per dozen). By virtue of her high fecundity, reproductive abilities and economy, she preponderates in numbers on the commercial egg farms in this province. In 1919-20 the University flock of pullets laid an average of 161.2 eggs. This record was obtained in a year that was exceptionally severe for B. C., and the number was also unfavorably affected by the fact that the birds were used for feeding practice for students. By much more thorough selection of breeders, by the better selection of pullets going into the laying houses and under more favorable climatic conditions, the average has been advanced to over 200 eggs per bird. The production of these pullets was remarkable for its uniformity, less than ten per cent of the pullets laying under 150 eggs, the R. O. P. minimum, in 365 days. This uniformity may be credited to the use of a better grade of breeders.

Slight outcroppings of broodiness in some families has occurred at times. By the elimination of these particular birds and families, lt seems quite possible to control broodiness in Leghorns. Some slight color variations have occurred at times in the form of feathers marked with black or salmon. By the ruthless culling of individuals showing any slight variations from pure white, very little of this has occurred in the last generation. Careful selection must continue in this regard to keep the color pure.

Observations About Wyandottes.

The B. C. Wyandotte has been bred largely for utility qualities. By continued selection for productive characteristics a bird of longer and stretchier proportions than called for by the standard has been evolved. By careful selection and breeding based on multiplication of good families from special matings, a one-hundred pullet unit flock has been developed at the University that last year averaged 191 eggs, and will this year average very close to the 200 mark. Like the Leghorns, these Wyandottes are also remarkable for their uniformity of production.

Some broodiness has been found, although some families have very little broodiness in them, while many members are entirely free from this character. The highest layers are not always non-broody, laying at an intense rate often between broody spells. Broodiness appears to be a directly inherited characteristic, and in Wyandottes seems capable of being controlled.

By breeding from males from good hens that lay large eggs, the size of egg has been considerably increased. This last year the average weight of eggs in the spring season ran very close to 26 ounces per dozen in our Wyandotte pullets. This gain can be attributed largely to the kind of males used. At the same time, hens that lay small eggs are being gradually eliminated as breeders. The quality of shell has been at the same time improved by this method of selection and breeding until the Wyandotte egg in some families cannot be seriously faulted.

High fertility and hatchability present the most difficult problems to overcome. Some Wyandotte hens like old 15 have proved excellent reproducers, however, having given 20 daughters that in their first year averaged over 200 eggs. This dam gave 75 per cent hatchability. The daughters of No. 8 are proving to be good reproducers as well. We have confidence that in time a strain of Wyandottes can be developed that will measure up high in fertility and hatchability of eggs and in livability of chicks.

Variation and Inheritance in Red Clover

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III.—CORRELATION OF CHARACTERS.

(*Concluded from Last Two Issues.*)

Numerous observations have been made which have led to the assumption that certain characters may be correlated, *i.e.*, hereditarily bound together and therefore appearing associated with each other.

Time of Development and Color of Flowers.

Holdefleiss (1) observed a retarded development in plants that were white-flowered, the white-flowered plants blossoming as much as four weeks later than the red ones (Exp. Sta. Rec. Vol. 31, 1914, p. 330). Whether this observation, however, can be used in support of the contention that a correlation may exist between time of development and color of the flowers, is very doubtful. Commenting on the subject, *Kajanus* (5, p. 3) is inclined to regard the coincidence of late flowering and white flowers in *Holdefleiss'* plants as accidental, as he himself has never observed any striking difference in blossoming time between white and red flowering forms.

Color of Seed and Color of Flowers.

As white-flowering red clover plants generally have yellow seed free from purple, it has been asserted that white flower colour and yellow seed colour may be correlated. Thus *Holdefleiss* (1) maintains that such correlation exists. *Gernert* (1 p. 88) observes that it was found that white-flowered plants always produced yellow (or pea) seed; he adds, though, that some of the pink and light-red flowered plants also produced yellow seed, while the seeds from dark red flowers were invariably dark purple. Finally Gmelin (2, p. 466) also maintains that white flower color probably always is coupled with yellow seed color.

This is, however, not the case. In the first place ordinary red-flowering plants may produce all kinds of seed, varying from yellow to deep purple. And, secondly, white-flowering plants have been observed which have purely white seed. White-seeded, white-flowering plants have thus been found by *Dr. H. Witte* at the Plant Breeding Station of Svalof, Sweden. Such a plant was also found by *Dr. Witte* and the writer in 1919 at a small railway station in S. Dakota.

Concerning other correlations between seed color and flower color a very interesting observation made by *Kajanus* (3 p. 767, and 5 , p. 3) may be mentioned. *Kajanus* has found that blue flower color seems always to be associated with a peculiar orange-brown seed color. He remarks that all blue flowered red clover plants which so far (up to 1914) have been harvested have had orange-brown seed.

Color and Weight of Seed.

A great number of observations bearing on the relation between weight and color of red clover seed have been made by various investigators. *Preyer* (1, p. 13) found when examining three commercial samples, that the purple seed in all the cases was heavier than the yellow. *Fruwirth* (2) came to a similar conclusion and so did *Kajanus* (3, p. 769) and *Eastman* (1, p. 98). *Haberlandt* (1) and *Von Rumker* (1, p. 204) however are on record as having found yellow seed picked out from commercial samples to be heavier than purple.

In the above cases the results were secured from mixed bulk samples. Such results, however, are, as will be readily understood from the discussion in the following, rather unsatisfactory as indicators of the existence of any real genetic correlation between color and weight.

Investigating the weight of differently colored seed from individual plants Bauman (1, p. 66) found that the weight of the seed of yellow seeded plants in so-called Bucheggberg Matten clover was lower than the weight of the seed harvested from dark-seeded plants. *Holdefleiss* (1) also asserts that in the material investi-

gated by him the yellow seed averaged lower than the purple (Exp. Sta. Rec. Vol. 31, 1914, p. 330.)

The findings of *Bauman* and *Holdefleiss* , that the weight of the seed from yellow-seeded plants is lower than that of the seed from dark-seeded plants can, however, not be taken as conclusive evidence of a universal weight and color correlation, as will be shown by an analysis of the relation between weight and color made by the writer. The writer collected, in 1911, seed from about 250 individual plants of red clover. The samples were subjected to an analytical investigation with the object of determining the range of variation as far as color, shape and weight of the seed were concerned, and also with the object of determining whether a true correlation between color and weight of the seed really exists. The following extract may be quoted (*Malte,* 1, p. 533). "From the 250 samples collected last summer, 39 samples which were either entirely yellow or almost yellow were picked out at random. The average weight of 100 seeds of those 39 samples was found to be 166.23 mg. Of the darkest colored samples there were also picked out 39 samples at random, 100 seeds of which were found to weigh 167.23 mg. This means that, the difference between yellow and very dark colored being only 1 mg., there does not seem to exist any correlation between the color and the weight of the seeds. That this really is the fact can be clearly demonstrated if, instead of basing the conclusion on the average weight, we study the weight from each single individual. The following table shows the distribution of the above mentioned 39 samples of yellow and of dark colored seed into the different weight classes. It shows beyond contradiction, that the weight of the seed varies independently of the color, *i.e.*, that there does not exist any correlation between color and weight."

Mg.	120 to 129	130 to 139	140 to 149	150 to 159	160 to 169	170 to 179	180 to 189	190 to 199	200 to 209	210 to 219	220 to 229	230 to 239	240 to 249
Yellow	1	1	5	7	12	5	4	2	.	1	.	.	1
Dark	1	5	6	5	5	4	5	2	2	.	4	.	.

Although the number of the samples of seed from individual plants classified in the table is small, there can be but little doubt that the figures really are expressive of the fact that the weight of the seed of individual plants is in no way associated with the color.

Kajanus (3, pp. 770-72) who approached the correlation question from a somewhat different angle arrived at a similar conclusion. *Kajanus* analyzed the figures bearing on weight and color secured from the progenies of mother plants having a known color and average weight of seed, and found that any fixed correlation between weight and color does not exist.

Color of Seeds and Agricultural Value.

It is commonly supposed, by seedsmen, as well as by farmers, that light-colored red-clover seed is inferior to dark-colored, the result being that the latter is generally preferred to the former. This preference is most often founded on the belief that yellow or otherwise light-colored seed is more or less immature, while dark-colored seed is looked upon as being fully mature. Consequently dark-colored seed is supposed to germinate better and to produce a heavier and more vigorous stand of clover than light-colored seed.

Concerning the germination of differently colored seed a few observations may be mentioned. Thus *Preyer* (1, p. 19), in germination experiments in the laboratory, found no perceptible difference in germination between yellow and purple seed. Similar results were obtained by *Beal* (1, p. 340) and *Kajanus* (3, p. 774). In this connection may also be mentioned investigations carried on by *Rostrup* with seed stored for several years. *Rostrup* (1, p. 23; 2, p. 66; 3, p. 45) found that yellow and purple seed retain their germination power in about the same degree or, which means the same, lose their vitality equally fast.

In the above-mentioned cases the ger-

mination tests were conducted in laboratories under conditions different from those existing in the field. In order to ascertain whether the results of germination tests would be similar, if the seed were germinated under more natural conditions, *Preyer* (1, p. 20) sowed samples of differently colored seed in large pots and found that, when the seed was allowed to germinate in soil of good quality, the yellow seed produced a larger percentage of plants than did the purple. As the result of several trials *Preyer* finally came to the conclusion that the yellow seed possesses a greater energy of growth than the purple seed. *Von Rumker* (1, p. 204) arrived at a similar conclusion, and so did *Fruwirth* (3, p. 185) and *Menke and Hillenmeyer* (1, p. 6-7).

Eastman, however, contends that purple seed tends to produce heavier yielding plants than does yellow (1, p. 101) and claims that the purple seed was found to germinate a little faster (1, p. 97). *Kajanus* (3, p. 774) also obtained results from which might be inferred that purple seed may germinate a trifle faster than yellow.

From the observations referred to it is obvious that no definite conclusions can be drawn. In some instances yellow seed has been found to germinate easier and to have a tendency to produce better and more vigorous plants. In other instances the reverse has been the case. The reason why such contradictory results have been obtained is the same here as it was found to be in the matter of supposedly existing correlations between weight and color of seed; the reason is that the seed used was of mixed origin, *i.e.*, was selected at random from samples representing the mixed seed crops from many different individual plants.

If, however, the germination of the seed from individual plants is tested, it will be shown that the seeds of different individual plants possess quite different powers of germination, irrespective of color. The findings of *Kajanus* (3, p. 775) may be quoted as illustrating this point, as follows:

No.	Colour	Per cent germination in 3 days	Per cent hard seed after 10 days
1.	Black-purple ..	29.5	31.0
2.	Dark-purple ..	63.0	5.0
3.	" ..	77.5	6.5
4.	Purplish-red ..	57.5	38.5
5.	Grayish-purple	63.5	23.0
6.	Grayish-green .	49.0	47.0
7.	Yellow with a touch of purple...	9.0	8.0
8.	" " ..	9.0	16.0
9.	Yellow	82.5	12.0
10.	"	70.5	22.5

From this table as well as from the observations quoted in the preceding paragraphs, it seems permissible to conclude that the color of red clover seed has no direct bearing on its value as far as germinating power and productive potentiality are concerned, in other words that there does not exist any fixed correlation between the color of the seed and its agricultural value. From the table in question the conclusion may furthermore be drawn that the germination power of red clover does not depend as much on its color as it does on the pedigree of the plants from which it is harvested.

Both conclusions are not only justifiable from the evidence available, but are also quite in accord with observations made on the subject of possibly existing correlations between type of plant and the color of its seed. The writer has made numerous observations on the subject and has come to the conclusion that no fixed relationship exists between the color of the seed and vegetative characters such as mode of growth, leafiness, stooling power, etc., of the plants by which the seed is produced. Seed of a color type which, from a commercial point of view, would be classified as No. 1, has on numerous occasions been collected from plants of the very poorest agricultural types. On the other hand yellow and otherwise light-colored seed has repeatedly been harvested from plants of very valuable types agriculturally. These statements, it must be explained, refer to clover plants growing side by side under identical soil conditions.

Under these circumstances, the writer must conclude that *the value of red clover*

seed depends largely on its pedigree. In support of this contention it may be related that a lot of very light-colored seed of late Swedish red clover, which some years ago was tested in the Provinces of Quebec and Alberta, proved to be capable of producing crops at least equal, to say the least, to crops obtained from the most fancy, dark-colored commercial seed obtainable in Canada.

SUMMARY.

1. Red clover is self-sterile and, as a result, germinable seed is obtainable only after cross-fertilization.
2. Red clover is very variable in respect to morphological characters. The various forms may be arranged in two rather distinctly defined groups, viz: European Red clover which has smooth or appressed hairy stalks, and American Red clover which is spreadingly hairy on the stalks.
3. Biologically, the various Red clover types may be classified as Early types which blossom comparatively early and are capable of producing two full crops of hay in a season, and Late types which blossom from one to several weeks later than the early ones and which produce only one full hay crop in a season.
4. Many local varieties exist which differ considerably from each other in respect to botanical characteristics and agricultural value.
5. Presence of leaf markings is dominant over absence and central markings appear to be dominant over basal ones. Varieties lacking the usual markings and therefore having all-green leaves have been developed.
6. Polyphylly is hereditary and, as a result, varieties can be developed which are characterized by a large percentage of polyphyllous plants.
   Whether polyphylly shall be regarded as an atavistic phenomenon or as a form of fasciation, is as yet an open question.
7. White-blossomed forms are well known, but blue-flowered Red clover types are very rare.
8. The red flower color, which is probably determined by two or more Mendelian factors, is dominant over white and blue.
9. White flower color being a recessive character, it is comparatively easy to develop constant, white-blossomed varieties. For the same reason blue-blossomed varieties may also be developed.
10. All mature seeds in Red clover plants are of the same color type but great differences in respect to the seed color exist between different individual plants.
11. The seed color is hereditary, dark-purplish being dominant over light-purplish and pink, and both dominant over yellow. Varieties having a distinct seed color or at least having a certain color type predominant can be developed.
12. The 1000-seed weight as found in individual plants, varies greatly. Very little is known about its inheritance.
13. Correlation between time of development and color of flowers has been claimed to exist, but it is very doubtful whether this really is the case.
14. No fixed correlation exists between color of flowers and color of seed, except perhaps in the case of blue-flowered types.
15. No correlation exists between color and weight of seed, the two characters varying independently of each other.
16. No correlation exists between color of seed and the agricultural value of the plants developed from the seed. Light-colored and dark-colored seed may each produce either poor or valuable plants. The inherent value of Red clover seed can therefore not be judged from its color.
17. The inherent value of red clover seed depends on its pedigree more than on anything else.

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Book Reviews

The Book of Live Stock, by Wade Toole (Musson Book Co., Toronto, $3.00).

There are too few agricultural text books by Canadian authors. The average professional worker, whether he is a college instructor or an extension worker, or both, has always been dependent upon certain "standard" volumes for reference purposes. In most instances these same Canadian workers have developed ideas of their own, have done original work and have, on the public platform, proved that important results have been obtained. But the value of those results is seldom applied to a wide constituency because, in most instances, the investigator or research worker is too fully occupied or perhaps too modest, to give his results publicity in book form.

Professor Toole is therefore to be congratulated upon taking the initiative. His book does not pretend to be original but as a practical volume for the reference of the live stock breeder, the student and the professional man, it undoubtedly will find a prominent position in the library. It is particularly well illustrated with photographs of the typical breeds of horses, cattle, sheep and swine. It describes fully the various breeds, gives practical instructions on care and management, briefly covers farm building problems and gives remedies for common animal diseases. An interesting feature of the volume is that it includes a market classification and a gestation table. There are also chapters on the judging of live stock, on stock feeds and their uses and on breeding problems.

This volume by the Professor of Animal Husbandry at the Ontario Agricultural College, is an important addition to agricultural text books. It is a well-illustrated, convenient and practical reference volume, and as such will be desired by many. Being a Canadian book, it should encourage the production of other volumes dealing with other lines of agricultural work.

Agricultural Economics, by Edwin G. Nourse (University of Chicago Press, $4.

It is difficult, in a brief review of this nature, to do justice to a book which covers so fully the wide range of agricultural economics. To say that the volume contains 900 pages, 17 subject divisions, 82 sub-divisions of these main headings and 290 selected and edited readings, perhaps indicates the size and scope of the volume; the difficulty lies in outlining the nature of the text.

The author, in his preface refers to the

volume as a "composite textbook," his reason being that "in this form it has the greatest teaching value." Primarily and obviously the book is for the student of rural economics and whether used for private study or for class-room purposes, it gives a complete and very thorough course in the subject. As a basis upon which to build up a solid structure, the author has taken the foundation principles laid down in the past, and has used the "discussion method" for presenting the arguments for and against those principles when applied to modern agriculture. The theory involved is first clearly stated and then followed up, for every problem of the subject, by clear and concise expressions of opinion upon economic facts.

For the use of high schools which are encouraging the study of agriculture, for agricultural colleges giving courses in this subject, for supplementing courses in farm management, marketing, etc., and for the student of rural conditions, rural business and rural advancement, this book is invaluable. Many authorities have contributed to the text and these contributions represent "a selection of materials in which economic principles are applied to the practice of agriculture." The subject of agricultural economics is studied from many angles and after being carefully read one lays the volume aside feeling that it will be often picked up again for further and more detailed study.

The author is Professor of Agricultural Economics at the Iowa State College.

Deseases of the Potato

By B. T. DICKSON,

Professor of Botany, Macdonald College.

(Continued.)

GROUP 2.

Diseases caused by Myxomycetes or Slime Moulds.

There are certain organisms which have not yet been definitely assigned to the animal kingdom nor to the plant kingdom because during part of the life history they move, feed and grow in such a manner that they are more animal-like than plant-like, while the reverse is the case at reproduction time. Such organisms are known as "Myxomycetes" and usually they are saprophytic. Two, however, are parasites causing diseases of considerable economic importance, viz., "Club-root" of cabbage, cauliflower, brocoli, etc., and "Powdery scab" or "Corky scab" of potato. This latter disease is caused by a slime mould known as *Spongospora subterranea* (Wallr.) Johnson.

Powdery Scab or Corky Scab (*Spongospora subterranea*).

Occurrence.

The disease has been known in Europe for nearly eighty years being described first by Wallroth in 1842 and it was noted by Barkeley in 1846 in England. The former investigator, however, considered that the disease was a smut. Brunchorst, in Norway, in 1886 studied the disease and named the causal organism *Spongospora*, placing it among the Myxomycetes. Güssow was the first to find the disease on this continent, some potatoes with typical scab spots being sent to him from several localities in Canada in 1912. Morse and Melhus then found evidence of the existance of the disease in Maine in the summer of 1913. It is now known to be present in Great Britain, Ireland, Northern and Central Europe, South America, Eastern Canada and in several northern localities of the United States of which the most important is Maine.

Symptoms.

The name of the causal organism indicates that only underground parts are attacked, namely roots, stolons and tubers. Roots are affected earlier in the season and on them white galls develop looking remarkably like the nodules on the roots of leguminous plants. Similar galls are produced on the stolons and less commonly on the part of the stem underground. Roots of all ages may be affected.

On the tuber the pustules begin to appear a little later in the season, usually when the potatoes are already of a fair

size. The stem-end is frequently first affected but as the tuber matures pustules may be found anywhere on the surface.

The first sign is a tiny, brownish-purple pimple on the surface surrounded by a more or less translucent zone, the whole not exceeding one-twelfth of an inch in diameter. This spot increases in size and the skin is gradually separated from the tissues below, which are stimulated to abnormal growth so that the protuberance is formed. Usually the epidermis is ruptured by this growth just about the time the organism is ready to go into the spore stage. The turned-back epidermis is typical of the pustules of powdery scab in uninjured specimens. (See Fig. 6). As the parasite matures the host cells are invaded, broken down and killed so that only remnants are found. At this time the parasite ceases its vegetative life and forms spores which are aggregated into balls. It is the spore balls together with remnants of cellular tissues which form the powdery mass found in the pustules at maturity

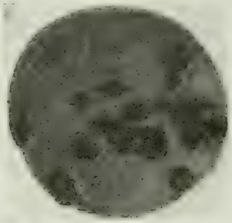

Figure 6. — Green Mountain tuber with typical spots. Note the turned-back epidermis leaving the masses of powdery material exposed for dissemination. (After Melhus et al, Jour. Agr. Res. 7: 1916.)

and which account for the common name "Powdery Scab". If one rubs out the powdery mass the tissue below is seen to resemble the epidermis of the tuber to a certain extent and in fact there is present a layer of cells functioning as a cork layer, which fact accounts for the other common name for the disease — "Corky Scab".

In Europe, Great Britain and Ireland, a more advanced stage of the disease is found where the tuber as a whole is malformed and tissues severely disorganized. This is known as the canker stage. That it does not occur in this country is probably due to the shorter growing season.

Life History.

Spongospora subterranea requires an abundant supply of moisture for germination, as well as warmth. Hence it is that the disease is more serious in poorly drained soils or during highly humid seasons. The spores in the spore ball germinate giving rise eventually to naked masses of protoplasm known as "plasmodia". A plasmodium moves slowly over a surface which is moist by means of psendopodia which are merely protrusions of the naked

Fig. 7. — Roots of potato with galls caused by Spongospora subterranea.

protoplasm. In this way, by moving in soil water among the interstices of the soil, the plasmodia reach roots, stolons and tubers. Whichever the part attacked the plasmodium penetrates the epidermis and gradually passes down to the cells below. These are stimulated to excessive growth so that "giant cells" are formed which may also divide, thus giving an abnormal number of cells in the tissue and accounting for the gall formation on root and stolon

and the protuberance on the tuber. In root and stolon galls the parasite eventually reaches the phloem in which most of the food manufactured is conducted and in this tissue most of the hypertrophy occurs. The tuber is somewhat modified because of its function as a large storage organ and the plasmodia do not, as a rule, reach the phloem but attack cells of the hypodermis and cortex.

Where a cell is covered by a plasmodium, or part of one, the wall swells and softens. That it is changed chemically is shown by the modified staining. Through the softened wall the plasmodium penetrates by

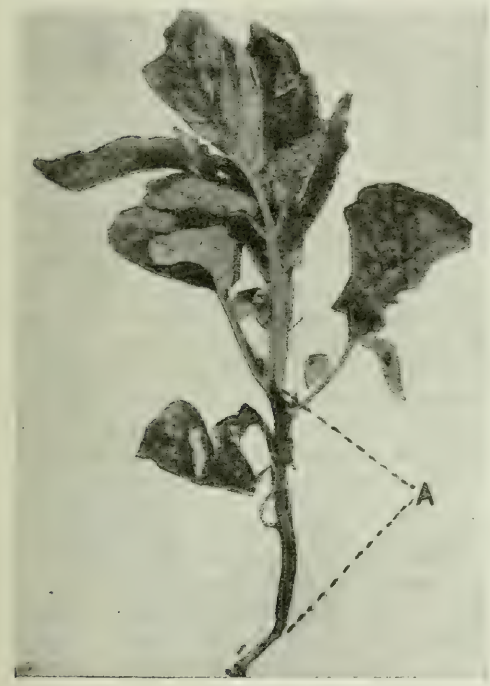

Figure 8. — Black-stem of potato. Note the blackened tissues at A and also the rolling of the leaves. (After Coons, Mich. Bull. 85; Fig. 9 also.)

protoplasmic protrusions which Kunkel calls "infecting pseudopodia". Once inside the cell the naked protoplasm of the myxomycete penetrates the limiting membrane of the host protoplast and the two protoplasms are to an extent miscible. It is when the cell is thus infected that hypertrophy begins. As the vegetative growth of the potato gradually ceases and maturation commences the spores of *Spongospora subterranea* are formed and these spores are aggregated into round masses known as spore balls. Such groups of spores are highly resistant to adverse conditions and are known to be able to live over in the soil at least three years.

Before leaving this discussion mention should be made of dry rots following *S. subterranea*. If, in the development of the pustule, it happens that the cork layer which cuts off the parasite is not laid down, drying-out or dessication follows in storage. The severity of this depends upon the number of pustules on the surface of the tubers which are not limited by a cork layer. It often happens that the spore balls are still present in the pustule in storage and if the temperature conditions are satisfactory for germination the spores in the balls will germinate and the resulting plasmodia will destroy cells surrounding the old pustule.

Naturally such pustules are open places for the entrance of wound parasites and one of the most important of these, *Phoma tuberosa* Melhus et al, causes serious dry-rot injury.

It must be pointed out that, secondary Spongospora injury, dry-rot and dessication may occur together in some cases.

Varietal Susceptibility.

Nothing can yet be said regarding resistance of this disease since it is probable that all the well-known potato varieties may be affected. Seasonal differences may account for some varieties escaping infection during one season but being affected another.

Other Hosts.

It is interesting to note that the roots of tomato are suceptible to infection by *S. subterranea* and that galls are formed similar to those on potato roots.

Control.

The following points are important in control:

1. Seed tuber selection.
2. Seed tuber treatment (formaldehyde, hot or cold).
3. Destruction of spore balls in diseased tubers by boiling before using as feed.
4. Sulphur 900 lbs. per acre applied broadcast reduces the amount of infection.
5. Practise long rotation if the attack is severe.

GROUP 3.

DISEASES CAUSED BY BACTERIA.

Black leg or Black stem-rot

(*B. atrosepticus v. Hall*).

The most important disease of potatoes caused by bacteria is that known commonly as "Black-leg". Other names are:—"Basal stem rot", "Bacterial black rot", "Black shank disease", "Black stem-rot". It is obvious that "Black leg" is an unfortunate name and that "Black stem-rot" or "Bacterial black rot" would be preferable. Throughout the course of this discussion, the name used will be "Black stem-rot".

Occurrence.

Black stem-rot of potatoes occurs in Northern and Central Europe, Great Britain, Ireland, Canada and the United States. Its economic importance varies with the season, being pronounced in moist, cool seasons. Murphy states that in 1915, 7 p. c. of the crop in New Brunswick and 10 p. c. in Nova Scotia and Prince Edward Island were destroyed by this disease. In Ontario still greater losses occur in years suitable meteorologically. A black stem-rot of potatoes was described first in America by Harrison in 1906.

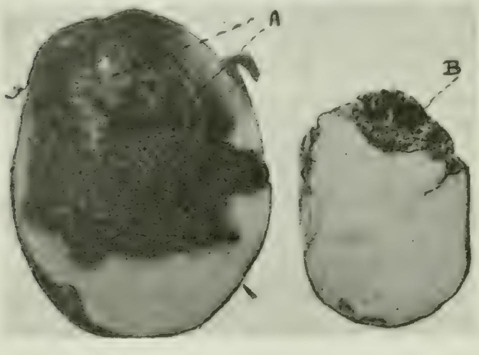

Figure 9.—Rot of tubers caused by the black-stem organism. Note at A the canals with creamy bacterial slime. Note at B the stem-end rot of the tuber.

Symptoms.

Infected plants usually begin to show late in June or early in July and are quite prominent by the middle to the end of July. Such plants are somewhat dwarfed, although not necessarily markedly so, and their leaves are pale or yellowish. Rolling of the leaflets along the midrib, somewhat as in true Leafroll, occurs but it can be distinguished by the fact that the leaflets are not rigid and brittle. If the infection happens to occur after the plant has grown considerably, and if the infection also happens to progress rapidly because of suitable humidity and temperature, the growth of the upper part of the plant will be suddenly checked. Thus internodes are shortened and leaves considerably dwarfed giving rise to a "rosette" top. If the attack is still more sudden and severe the stem may wilt suddenly and fall over without previous symptoms other than the flaccid leaves.

On pulling gently at such stems they easily come away at the level of the ground because there the tissues are rotted through. (Fig. 8.) From the rotted stem tissues the bacteria may travel along the stolons to the tubers. In these, if conditions are suitable for the organism, a total rot may occur, but if conditions happen to be less suitable only stem-end infection may occur. This may not be easily visible to the naked or unobservant eye and yet it is the important factor in overwintering.

Life History.

The organism overwinters in the stem-end of slightly diseased tubers where a low temperature keeps it dormant. It is found that growth is slow at 46 deg. F. and it ceases at 39 deg. F.

The organism attacks parenchyma cells dissolving the middle lamellae and this accounts for the typical soft rot which occurs. It does not specifically attack vascular tissues but by rapid multiplication the bacteria plug up the xylem thus preventing the upward passage of water and accounting for the rolling of leaves, rosette top and wilting.

As to the organism causing the disease it is highly probable that more than one may give rise to similar symptoms. Morse inclines to the view that in Maine it is *B. atrosepticus* van Hall. This typically attacks stems but does not cause excessive tuber rot. Harrison, from Ontario material, described *B. solanisaprus* which caused severe tuber rot in addition to black stem-rot. This was the first description of such a disease in America. It has since been found in Michigan (Fig. 9) but is ascribed by Coons to *B. atrosepticus* van Hall. In the Western and irrigated parts of the United States an organism causing a similar tuber rot and stem-rot is ascribed by Shapovalov and Edson to *B. phytophthorus* Appel.

Control.

Whatever the specific organism it is reasonably certain that in Canada it cannot overwinter in the soil. Hence it is to the seed tuber that one must look for control. The chief points to bear in mind are:

1. To select sound tubers for seed.
2. If it is impossible to guarantee the soundness of the seed tubers then treat with formaldehyde — 2 pints in 30 gallons of water at 119 deg. F. to 122 deg. F. for five minutes. The tubers are then covered for one hour and dried.

THE O.A.C. JUDGING TEAM.

The Ontario Agricultural College graduates in particular, and Canadian Agricultural graduates in general, must be proud of the success achieved by the O.A.C. judging team at the annual International Live Stock Exposition held in Chicago a few weeks ago. Teams from twenty-one agricultural colleges (18 from the United States and 3 from Canada) entered the competition, and the final figures placed the O.A.C. team second in the competition with 4146 points out of a possible 5000 points, the winning team (Ohio) having 4178 points.

A further analysis of the results is interesting. One member of the O.A.C. team (F. W. Walsh) obtained the highest individual score in the whole competition—891 points out of a possible 1000 points. The other four competitors of the team came 15th, 62nd and 59th in the whole competition. There were 105 men in the competition.

Before going to Chicago, the O.A.C. boys had seen most of the good herds and flocks in Western Ontario. Just before the competition they spent a week in the United States at Purdue University and Illinois University and also visited several breeders in order to complete their training on American types of stock. They were therefore in good form at the time of the competition and the team was one of the best that ever represented the O.A.C.

Great credit is due to Wade Toole, Professor of Animal Husbandry at the O.A.C., to whom the success of the team is in large measure attributable.

NEW APPLE VARIETIES.

The breeding of new varieties of apples receives much attention at the Central Experimental Farm, Ottawa. Among those selected as being of sufficient merit for naming are: Currie (Northern Spy seedling) large in size and of form, conical to oblong conical, slightly resembling Northern Spy in color and shape and has a suggestion of the flavor of sops of wine; Hume (McIntosh seedling) medium in size, roundish to oblate, slightly ribbed, suggests McIntosh in color, flesh, perfume, and flavor; Merlin (Shiawassee seedling), size medium, form oblate, resembles Shiawassee in shape, flesh and flavor; McSweet (McIntosh seedling), resembles McIntosh in outward appearance, a good sweet apple; Omesal (Salome seedling), large, resembles Salome in appearance, flesh and flavor, a good keeper; Orsino (Shiawassee seedling), large, resembles Shiawassee in flesh and flavor, attractive and a good dessert apple: Oshtosh (McIntosh seedling), resembles McIntosh somewhat in flesh and flavor, not quite as good in latter respect, distinctly of Fameuse group; Patricia (McIntosh seedling), resembles McIntosh in flesh and perfume, handsome and a good dessert apple; Peace (Langford Beauty seedling), resembles Langford Beauty in appearance, flesh and flavor, a handsome apple; Shishee (Shiawassee seedling), above medium in size, resembles Shiawassee only in having white fine-grained tender flesh; Spiotta (Northern Spy seedling), medium to large, resembles Northern Spy in color, flesh and flavor; Spiro (Northern Spy seedling), medium, resembles Northern Spy in flesh and flavor; Sweetosh (McIntosh seedling) medium to large, rather dull in color, but is attractive and a good sweet apple.

Three crab apples have also been recently named, namely, Lora (Progress seedling), fruit crab-like but rather large for a crab; Printosh (Prince and McIntosh), rather large, but having a good flavor, and Rosilda (Prince and McIntosh), resembles McIntosh rather in color, though brighter; promising as a large crab apple.

A New Hardy Variety of Winter Wheat

R. SUMMERBY, Professor of Cereal Husbandry, Macdonald College, P. Q.

Although wheat is not a crop of greatest importance in Quebec, a sufficient area is grown to warrant consideration being given to its improvement. One phase of this work which has received attention in the Agronomy department of Macdonald College is that of testing the suitability of autumn sown varieties as regards hardiness and yield, and the further improvement of those that are best adapted.

A test of a dozen varieties shows that winter wheat has killed out badly three years out of eleven under trial, that when it does not winterkill, a much higher yield is obtained than with spring wheat, that in spite of winterkilling its average yield approximates that of spring wheat, and that much difference exists as regards the hardiness of the varieties tested.

The following data relative to the four best varieties gives the average per cent. stand for eleven years, the average yield for the eight successful crop years, and the average yield for eleven years. In the latter case the yields for the three years when winterkilling was severe have been considered as nil.

	% Stand 11 yrs	Yield per acre 8 yrs.	Yield per acre 11 yrs. of test
Dawson's Golden Chaff. Ave. all strains.	52.2	47.92	34.85
Turkey Red (G)	53.1	41.86	30.44
Kharkov (0)	66.7	44.03	32.02
Red Velvet Chaff (0)	62.3	43.35	31.52

Dawson's Golden Chaff is the highest yielder when winterkilling is not high. Kharkov, however, is hardier as indicated by the high average per cent. stand. A more detailed analysis of the stand by individual years further emphasizes this point. The percentage winterkilling in the seven years that it was noted are here included.

Percentage Winterkilled.

	1907	1908	1909	1910	1911	1912	1920	Av. 7 yrs.
Dawson's Golden Chaff (Ave. all strains)	43.3	40	34.6	7	74.3	89	98.5	55.24
Turkey Red (G)	0	20	35	38	83	92	98.5	52.35
Kharkov (0)	0	18	5	30	78	50	65	35.14
Red Velvet Chaff (G)	0	33	35	5	35	72	96.5	39.5

In this respect Kharkov stands equal or superior to all others in five years out of seven, and the average winterkilling is noticeably less than with the hardiest of the other varieties.

With a view to improvement as regards hardiness and yield, several thousand plants of several varieties were selected in 1912 and the best appearing ones carried forward to allow of natural selection for hardiness, and for the study of their field characters. The strains of Kharkov were so much superior to the others that the latter were discontinued. Six strains of the former have been in the field test since 1917 and have thus completed a five year period. Kharkov 2212 is apparently superior to others as regards hardiness and yield. Data regarding hardiness as indicated by percent. stand and winterkilling, together with yield, are given below for Kharkov 2212, the parent variety Kharkov (0), and another strain of Kharkov which was grown as a check every fifth plot.

	1917	1918	1919	1921	Ave. 4 yrs.	Percent Winterkilled
Kharkov 2212	92	78	85	75	82.5	30
Kharkov (Leth) (Av. of all checks) . .	94	24.6	85	74	69.4	93.5
Kharkov (0)	93	60	87 5	75	78.9	65

	Yield in bushels 1917	1918	1919	1920	1921	Ave. 5 yrs.	Ave. 4 yrs. (1920 excl.)
Kharkov 2212	48.33	33.50	57.50	40.00	38.77	43.62	44.52
Kharkov (Leth) (Ave. all checks)	48.61	14.70	58.96	....	37.80	32.01	40.01
Kharkov (0)	50.42	36.00	45.62	....	41.67	34.74	43.43

Hardiness is clearly indicated by percentage stand in 1918, and by winterkilling in 1920. The large amount of winterkilling in 1920 in Kharkov (Leth) and Kharkov (0), resulted in the stand of these two strains being too poor to allow to mature. The five year average while not strictly comparable on this account, indicates the value of the Kharkov 2212 to the farmer.

Apart from this statistical data, careful observation in many other tests where comparison was possible, has abundantly shown that Kharkov 2212 is superior to all others tested as regards hardiness and yield. In view of its behaviour the department has sent out a number of samples to experiment stations and to growers under the name of Kharkov 22 M.C. Kharkov 22 is an awned variety having glabrous white glumes, medium sized, semihard to hard red kernels. Its spike is somewhat longer than the Kharkov variety and has a slight taper to the apex. It has average tillering ability and the characteristic recumbent habit of autumn growth possessed by its parent. It has long narrow leaves and has good length and strength of straw.

Kharkov 22 M.C. Average yield for five years, 43.62 bushels. Average height 40.7 inches.

GRADING DAIRY PRODUCE

Two objections have been made to the Dominion Act to Regulate the Grading of Dairy Produce. One is that the producer would be placed under additional expense, and the other that all the grading would be done at Montreal. The Dominion Dairy and Cold Storage Commissioner, both in the public press and at dairy meetings, has denied that there is any reason in these objections, as no additional expense whatever will be incurred by the producer, and there is nothing either in the Act itself or in the regulations to justify the suggestion that the grading would all be done in Montreal. All Canada's competitors in the British market, such as Ireland, Denmark, Holland, New Zealand and Australia, have such regulations, and those of Denmark are more stringent than are those adopted for this country.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

If it were possible for the General Secretary to meet each member of the Society individually he would be able to extend his holiday greetings in the most approved fashion. Since that is not possible he wishes to extend them through these columns.

The past six months have been at times very depressing, but there has always been the necessary element of optimism to make for progress. The festive season finds us in splendid condition for a full appreciation of all that has been accomplished.

It is difficult to attribute to any single factor the successful doing of any task. In the case of the Society, progress has been due to the splendid measure of support rendered by every member, and more particularly by the Secretaries of the various local branches and the members of the Dominion Executive. Without that support the Society would now be standing still and might even be moving in the wrong direction. Every member should therefore take personal pride in what has been done, and, by continued support, help to carry his organization rapidly forward.

There is absolutely nothing to worry about. Membership fees have been mostly paid and those that have not have been assured, so that revenue from that source is safe and steady. The added revenue from circulation and advertising is quite encouraging and will ultimately improve the whole financial situation. What is needed most is the continued personal support of every member.

Read the editorial pages of this issue carefully, and decide to lend your personal support to the effort now being made to place your official organ on a sound business basis.

A Merry Christmas, and Prosperity in the New Year!

BRITISH COLUMBIA BRANCH.

Forty-two members of the B. C. Branch attended an Autumn meeting which was held at the University Club, Vancouver, on Friday, November 18th. Mr. J. W. Berry, President of the Fraser Valley Milk Producers' Association and the first B. C. honorary member of the society, was among those present and gave an interesting talk.

President Klinck in giving his talk on "Some Aspects of Agriculture in Europe" presented a picture of rural England which was most interesting and quite different from that usually presented. The typical rural England of fine homes set off by beautiful velvety lawns, first-class stock in the barns and splendid crops in the fields, was not the rural England of the summer of 1921. This was largely due, he stated, to the changes brought about by the seven years of labour shortage and the unusual drought of the past summer. The features of the country-side which impressed him most were the unusual sights of neglected hedges and ditches around the farms, neglected country estates, together with other evidences of labor shortage. In many instances the hedges were even on fire and apparently no attempt could be made to save them. Scarcely a green lawn was visible in the cities and towns, and the shrubbery presented a parched appearance. Watering the lawns as we know it in this country was apparently impossible.

Denmark was visited and great interest taken in scientific methods employed in handling agricultural products for export, particularly the largely exported products of eggs and bacon. A very interesting open air and agricultural museum was visited at Lingby, where whole homesteads were preserved in order to give correct impressions of agricultural conditions to future generations. Summing up Denmark, he said that the expression "Few have too little and fewer have too much" is particu-

larly true of this small country.

Southern Sweden far exceeded President Klinck's expectations. The crops were wonderful; one field of 60 acres in extent, for example, which he visited, yielded an average of 106 bushels of wheat per acre. Svalov and Stockholm were among the places visited and his itinerary took him to within 200 miles of the Arctic Circle. Northern Sweden was a great surprise, and although not as good as the South, is yet a remarkable agricultural country.

In concluding his remarks by alluding to the devastated districts of France, he gave it as his opinion that it would take many years to restore the land to the former high state of fertility. "Large tracts are still untouched, and perhaps it may be twenty years before it will be back again to normal."

Messrs. W. H. Hicks and A. F. Barss gave a joint report on the Winnipeg Convention which conveyed to the minds of those present a vivid picture of that function. Their papers were brief, lucid and well presented, and left the impression that the B. C. delegation did most efficient work.

The valuable paper on "Recent Advances in Scandinavian Agriculture," by Professor P. A. Boving, given at the same meeting, will be reported on in the next issue of this journal.

NOTES.

T. F. Ritchie, (Macdonald '14) has been transferred from the Experimental Farm at Lennoxville, P.Q. to the Central Experimental Farm at Ottawa, with the Horticultural Division.

The present address of I. T. Barnet (O. A.C. '14) is 509 Richards St., Vancouver

Walter N. Jones (Macdonald '19) is taking post graduate work in dairying at the Iowa State College, Ames.

C. F. Peterson, (Macdonald '20) is now at Athabasca, Alberta, as field supervisor for the Soldiers' Settlement Board.

Hector Leblanc (Montreal '19) has been transferred as District Representative from Lennoxville to Maria, Bonaventure Co., P.Q.

J. H. Bridge, (Manitoba '13) has left his farm at Prongua, Sack., and is now with the Extension Department of the University of Saskatchewan.

P. C. Connon, (O.A.C. '20) was married on October 26th to Miss Olive Hayes of Ottawa. Connon is with the Soldiers' Settlement Board at Prince Albert, Sask.

F. C. Patterson, (Toronto '15) is District Representative for Durham County, Ontario, with headquarters at Port Hope.

J. A. Steele, (Toronto '20) has recently been transferred by the Soldiers' Settlement Board from Victoria, B.C., to Chinook, Alberta.

APPLICATIONS FOR MEMBERSHIP.

W. E. Ashton (McGill, 1920, B.S.A.) Waterloo, P.Q.

R. H. Clemens (Toronto, 1912, B.S.A.) Arthur, Ont.

B. A. Cooke, (Ames, 1912, B.Sc.) 405 Kerr Block, Regina, Sask.

A. F. Curran, (Associate Member) 347 St. George St., Moncton, N.B.

W. H. Fairfield, (Toronto, B.S.A.) Exp. Farm, Lethbridge, Alberta.

W. M. Fleming, (Alberta, 1919, B.S.A.) Box 235 Duncan, B.C.

Jas. H. Hare, (Toronto, 1912, B.S.A.) 0922 First Ave., N.W. Calgary, Alta.

J. R. Higgins, (Toronto, 1919, B.S.A.) 0922 First Ave., N.W. Calgary, Alta.

A. R. Jones, (McGill, 1921, B.S.A.) Exp. Farm, Charlottetown, P.E.I.

C. P. Leckie, (British Columbia, 1921, B.S.A.) University of B.C. Vancouver.

F. F. McKenzie, (British Columbia, 1921, B.S.A.) Box 57, Marpole, B.C.

A. W. Peterson, (McGill, 1921, B.S.A.) Exp. Farm, Charlottetown, P.E.I.

E. F. Pineau, (Associate Member) 347 St. George St., Moncton, N.B.

William Popp, (Manitoba, 1920, B.S.A.) 107 MacDonald Ave., Winnipeg, Man.

J. C. Ready, (Toronto, 1904, B.S.A.) Box 427, Chilliwack, B.C.

B. J. Sallans, (Manitoba, 1921, B.S.A.) 531-12th St., Brandon, Man.

E. F. Small, (Toronto, 1916, B.S.A.) Cloverdale, B.C.

R. E. Stone, (Nebraska, 1907, B.Sc., Cornell, 1913, Ph.D.) O.A.C., Guelph, Ont.

A. T. Webster, (Manitoba, 1914, B.S.A.) Rocanville, Sask.

Usage Economique de la Paille dans le Rationnement des Vaches à l'Entretien

Par G. TOUPIN,

Professeur à l'Institut Agricole d'Oka.

La paille seule — la paille d'avoine, n'est pas suffisante pour l'entretien des vaches l'hiver. Elle est trop pauvre en matières protéiques, et la mise en valeur des principes nutritifs qu'elle contient coûte trop cher à l'organisme.

Les dernières tables d'alimentation, basée sur les résultats accumulés des recherches faites à l'étranger, notamment aux Etats-Unis, en Angleterre, et en Allemagne, donnent comme exigences nutritives pour une vache à l'entretien du poids de 1,000 lbs. les chiffres suivants:

Mat. sèche—12 à 21 lbs.
Prot. dig.—7 lbs.
U. Nutritives—7.925 lbs.
R. H.—1:10.3.

Or la paille d'avoine ne contient que 1 p.c. de protéine digestible et 48.8 U. N. par 100 lbs. L'on voit tout de suite qu'avec une si faible teneur en matières azotées digestibles et un tel coefficient de digestibilité, ce fourrage servi seul aux vaches à l'entretien *ne peut pas les entretenir.* En effet, en supposant pour un instant que la vache possèderait une capacité de digestion illimitée, une ration de 50 lbs. de paille d'avoine ne pourrait même pas fournir à l'organisme les .7 de matière azotée nécessaire pour réparer l'usure quotidienne de ses tissus. A bonne *"gueule"* la vache qui peut manger 20 à 25 lbs. de paille par jour. Cette quantité cependant n'apportant à l'organisme que .2 à .3 de livre de protéine digestible — contrairement à ce qu'indiquent les tables d'alimentation— ne peut donc suffire à combler les déficits journaliers et la vache maigrit tout le long de l'hiver. On s'est trop bien dans quel état s'en vont au pâturage les vaches nourries tout l'hiver de cette pitance pour qu'il soit nécessaire d'argumenter plus longuement sur l'inhabilité de la paille à entretenir le bétail.

Faut-il conclure de là que ce fourrage n'a aucune valeur alimentaire? Ce serait commettre — surtout en ce temps de disette — une grave erreur. Servie en combinaisons, par exemple, avec une bonne moulée, ou encore avec du foin de trèfle, ou de l'ensilage, ou des racines, la paille d'avoine devient un fourrage précieux apportant à la ration, sinon beaucoup de principes nutritifs, du moins le volume qui est un facteur de tout premier ordre dans la ration. Si une vache ne peut vivre qu'à la paille, elle ne peut guère mieux prospérer avec des concentrés seulement tant est important le volume dans la ration. La paille d'avoine, pour être utilisée avec avantage, doit donc être servie en combinaisons avec d'autres aliments et dans la mesure de dix à douze livres par jour au maximum.

Mettant à profit une expérience faite l'an dernier avec de la paille et me basant sur les tables d'alimentation de Wolff et Lehmann modifiées par Henry et Morrison je crois que l'on pourrait trouver dans les combinaisons d'aliments qui vont suivre des types de rations assez justes pour l'usage économique de la paille d'avoine.

Exigences nutritives pour une vache à l'entretien du poids de 1,000 lbs.

Mat. sèche—12 à 21 lbs.
Prot. dig.—.7 lbs.
U. nutritives—7.925 lbs.
R. N.—1:10.3.

Mélanges recommandés.

No 1	No 2
3 parties avoine	3 P. Criblures
3 parties son	3 P. Son
3 parties Blé-d'Inde	3 P. Blé-d'Inde
1 parties tourteau	1 P. Tourteau

Remarques

I.—La relation nutritive pour vache

d'entretien du poids de 1,000 lbs peut varier de 1:10 à 1:16.

II.—Ne choisir dans ces rations que celles qui se rapprochent le plus du standard et ne servir les autres qu'en cas d'obligation, la ration No 4 par exemple.

III.—Calculer le coût de ces rations selon le prix des fourrages et des concentrés dans la région. En tenir compte dans le choix de la ration.

IV.—Ne pas chercher dans ces calculs une exactitude absolue ils sont suffisamment justes toutefois pour servir de guide.

RATIONS RECOMMANDEES

	Matières sèches	Prot. dig.	U.-nutritives	R. N.
No 1				
Paille, 10 lbs.	8.8	.1	4.56	
Mélange, 5 lbs.	4.5	.58	3.5	
	13.3	.68	8.06	1:10.8
No 2				
Paille, 10 lbs.	8.8	.1	4.56	
Trèfle, 8 lbs.	6.9	.6	4.	
	15.7	.7	8.56	1:11.2
No 3				
Paille, 5 lbs.	4.4	.05	2.25	
Foin mêlé, 13 lbs.	13.	.64	7.69	
	17.4	.69	9.94	1:13.4
No 4				
Paille, 10 lbs.	9.	.1	4.56	
Ensilage, 40 lbs.	10.5	.43	7.08	
	19.5	.53	11.64	1:20
No 5				
Paille, 10 lbs.	9.	.1	4.56	
Ensilage, 30 lbs.	7.9	.3	5.21	
Son ou mélange, 2 lbs.	1.8	.24	1.21	
	18.7	.64	10.98	1:16
No 6				
Paille, 5 lbs.	4.4	.05	2.25	
Ensilage, 30 lbs.	7.9	.3	5.21	
Son ou mélange, 3 lbs.	2.7	.39	1.80	
	15.	.74	9.26	1:11.5
No 7				
Paille, 10 lbs.	9.	.1	4.56	
Racines, 30 lbs.	2.8	.24	2.10	
Son ou mélange, 3 lbs.	2.7	.36	1.83	
	14.5	.70	8.49	1:11
No 8				
Paille, 5 lbs.	4.	.05	2.25	
Blé-d'Inde non ensilé, 15 lbs.	12.0	.45	8.05	
Mélange ou son, 4 lbs.	3.6	.44	2.8	
	19.6	.94	13.10	1:12.8

Quelques Aspects d'un Problème

Par HENRI C. BOIS,

Professeur à l'Institut Agricole d'Oka.

L'exode rural a déjà fait le thème de discours si nombreux, il a déjà fait verser tant d'encre que vouloir y revenir aujourd'hui est s'exposer à n'être pas lu. C'est un sujet qu'affectionnent particulièrement les orateurs pris au dépourvu et les rédacteurs privés de collaboration. Il est si facile de parler ou d'écrire là-dessus! Les clichés sont nombreux et parfois d'un effet passable. On les emploie sans vergogne, à tort et à travers. Ils ont par ailleurs l'avantage d'être d'accord avec les opinions reçues. Il n'y a pas de risques à prendre, pourquoi se gêner? Cette manière d'agir, vieille de plusieurs années si on en juge par la note générale que donnent sur cette question les publications agricoles du passé, a d'abord dégoûté le lecteur en le saturant et a contribué en plus à répandre et à propager des idées d'une exactitude souvent douteuse.

Le citadin, à de rares exceptions près, considère la désertion des campagnes comme un sinistre augure. C'est pour lui le signe d'une raréfaction prochaine des produits agricoles amenant nécessairement une augmentation dans les prix. Et notre homme de broyer du noir en songeant à tout cela. Ce pessimisme ne s'appuie heureusement sur rien de solide, car il importe peu que le nombre des cultivateurs diminue si la capacité de production de ceux qui sont restés aux champs s'est accrue dans de justes proportions. L'histoire prouve que la population rurale a toujours eu une tendance à s'abaisser à mesure que la science agricole se vulgarisait et que les machines se perfectionnaient. Là où trois cultivateurs étaient nécessaires autrefois, un seul peut maintenant suffire à la tâche. D'après un rapport du Service du Travail, à Washington, il faut aujourd'hui environ treize minutes pour produire un minot de blé, tandis qu'en 1800 il fallait trois heures et neuf minutes. Le coût de la production est aussi devenu moindre. Il est plus économique de produire à l'heure présente un minot de blé au prix de revient d'environ $0.70 qu'il ne l'était en 1830 lorsque le même produit coûtait $0.30 au producteur; parce que $0.30 en 1830 avait plus de valeur que n'en possède $0.70 en 1921. Le pourcentage des cultivateurs américains par rapport à la population totale des Etats-Unis est tombée de 98 p.c. à 35 p.c. entre le 19e et le 20e siècle et en dépit de cette diminution formidable la production du blé par tête et par acre s'est élevée de 5.5 à 8.66 minots.

On comprend plus facilement comment il se fait que la population rurale puisse s'abaisser sans que la famine soit à craindre. Les agriculteurs qui ont quitté leurs terres se sont dirigés vers la ville. Ils ont apporté à l'industrie et au commerce le concours de leur intelligence et de leurs bras; ils ont travaillé dans leur sphère nouvelle à l'avancement et au développement de la civilisation. Il s'est trouvé à cette époque des hommes à courte vue qui, sans aucune restriction, ont condamné ce mouvement comme il s'en rencontre encore de nos jours qui suivent les mêmes sentiers. Nous ne prétendons pas que ces réajustements entre les deux grandes classes d'une nation, urbaine et rurale, s'effectuent toujours sans tiraillements et sans excès d'un côté ou de l'autre, non, il en est plus souvent ainsi qu'autrement, mais c'est uniquement là que se trouve le danger. Sous l'influence de causes accidentelles la marche des paysans vers les villes peut parfois s'accélérer au point de devenir inquiétante. Ce qu'il importe d'éviter c'est la trop grande affluence des cultivateurs dans la cité, afflux que provoquent un revenu trop faible obtenu des terres mises en culture, soit à cause de leur infertilité, soit à la suite d'une mauvaise administration, un développement trop rapide de l'industrie dans un pays jeune comme le nôtre, une organisation insuffisante de la vie sociale à la campagne, un système défectueux d'éducation et d'instruction.

La simple énumération de ces quelques causes de l'exode rurale montre combien elles sont diverses et complexes.

On peut et même on doit travailler à diminuer la désertion des campagnes, mais il est aussi dépourvu de sens de penser parvenir à la stopper complètement que de

croire arrêter le vent en étendant les bras. Il y aura toujours un pourcentage, plus ou moins élevé selon les circonstances, des cultivateurs qui abandonneront leur profession comme il se rencontrera en tout temps des citadins qui par goût ou par nécessité s'en retourneront vers les champs. Notons cependant que ces derniers sont ordinairement de beaucoup moins nombreux que les premiers.

La plupart des auteurs qui ont traité cette question déplorent presque unanimement la dépopulation rurale et la regardent comme une tendance malsaine, un signe de l'affaiblissement de la vigueur de la race et un indice de la diminution de l'amour du travail. Nous doutons que ces hommes aient raison de condamner l'exode rural en soi. Dans quelques cas particuliers il se peut que des individus délaissent la terre par paresse ou par désir de jouissance, mais d'une manière générale on peut affirmer que l'abandon du sol est plutôt le résultat du désir de trouver de meilleures conditions sociales, des facilités plus grandes d'exercer profitablement l'activité manuelle ou intellectuelle. Sont-ce là de mauvaises aspirations? La population n'a-t-elle pas une tendance naturelle à se diriger vers les industries les plus profitables tant qu'elles restent les plus profitables. "Nous pouvons déplorer l'exode rural mais le combattre sera futile tant que la main-d'oeuvre et le capital recevront une rémunération plus substantielle de la fabrication que de l'agriculture." * Un cultivateur qui ne réussit pas n'est pas nécessairement un ignorant ou un maladroit. Il gaspille en peinant sur un sol ingrat ou en conduisant mal ses opérations culturales une somme considérable de travail et d'énergie qu'il eut peut-être mieux utilisée à l'usine.

Ce qui est mal, ce n'est pas que cet homme ait changé d'état que de fermier il soit devenu ouvrier, mais le mal se trouve dans le fait qu'il n'a pas trouvé à la campagne les renseignements et l'aide qui auraient amélioré sa situation.

Ce qui est mal, c'est qu'on ait permis à l'industrie artificielle de prendre une trop grande expansion et de drainer ainsi le travail et le capital vers les centres. Le développement de l'industrie doit être subordonné à la mise en valeur des ressources naturelles d'un pays. On n'a pas mal oublié ce principe chez nous et en haut lieu.

Ce qui est mal, c'est que le cultivateur ne puisse pas jouir dans son milieu des relations sociales qui l'attirent à la ville.

Ce qui est mal, c'est que l'éducation que reçoivent les jeunes ruraux leur donne un idéal tout autre que celui qu'on devrait leur inculquer.

Maintenant que penser de l'habitude qu'on certains de ne pouvoir écrire dix lignes sur la désertion des campagnes sans servir aux lecteurs la traditionnelle citation du poète ou du romancier à la mode? La bonne poésie est une fort belle chose et nous savons l'apprécier à l'occasion, mais il ne faut l'employer qu'avec circonspection dans l'étude d'un pareil problème. De même en et-il des romans. En général les remèdes qu'on préconise dans ces ouvrages, soit en vers soit en prose, sont des plus variés, les uns sont mêmes étranges. Cependant l'entente semble assez parfaite quand il s'agit d'affirmer "Que l'agriculture manque de bras, que la terre se meurt..." Devant un pareil concert de lamentations il est assez difficile de garder quelque sang froid. Il faut toutefois essayer d'y voir clair. Nous n'avons pas la prétention de trouver tous les matériaux qu'il faudrait pour construire la barrière à opposer aux paysans en mal de devenir citadins, mais nous croyons que d'une manière générale on ne s'est pas assez préoccupé du côté économique de la question. "La terre se meurt" non pas parce qu'on "Ne la comprend plus", mais bien parce que, selon l'expression populaire, "On y travaille trop pour ce qu'on y gagne". C'est surtout cela qu'on devrait essayer de guérir.

Certes, nous admettons volontiers qu'une citation des Bucoliques ou des Eglogues puisse donner une excellente apparence littéraire à un article, mais il ne faut pas en abuser et encore moins s'arrêter là. Que les poètes romains ou autres, anciens ou modernes trouvent matière à sonnets ou à quatrains dans l'observation des travaux du laboureur, nous n'y voyons aucun inconvénient, mais nous les jugeons un peu originaux lorsque pour retenir dans son milieu un campagnard qui veut s'en éloigner, ils n'ont rien autre chose à lui repré-

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* Plan et développement ruraux, par Thomas Adams, Commission de la Conservation, Ottawa, 1917.

senter que la beauté, la discutable indépendance, la poésie de sa profession.

D'autres auteurs, un peu plus malins, s'attaquent au patriotisme et cherchent à démontrer à "l'habitant" qu'il commet un crime de lèse-patrie en abandonnant sa terre. Cette doctrine, soutenable dans des circonstances très particulières, ne peut cependant pas être mise à la base d'un système destiné à enrayer l'exode rural. Le cultivateur qui ne réussit pas s'il a de meilleures aptitudes pour l'art mécanique, par exemple, ferait ouevre de discernement en abandonnant la charrue et en allait s'établir à la ville. Il deviendrait ainsi plus utile à la communauté. Nous ne croyons pas que l'amour du pays natal puisse exiger d'une classe de citoyens en particulier de se résoudre à vivoter dans une profession lorsqu'ils pourraient vivre plus facilement et plus aisément en en pratiquant une autre.

La désertion des campagnes n'est pas uniquement une question économique. Elle dépend aussi de bien d'autres causes. Le facteur argent y joue un rôle certainement plus important qu'on ne le croit généralement. On devrait en tenir meilleur compte quand il s'agit d'adopter une politique susceptible de réduire le nombre de ceux qui quittent la ferme pour la ville. Parmi ces déracinés, il se rencontre plus de miséreux que de véritables déserteurs. Ne l'oublions pas!

Application aux Laits Altérés et aux Laits Concentrés Sucrés du Dosage du Lactose en Présence d'Autres Sucres Réducteurs

Par L. LE GRAND,

Ingénieur-Agronome.

(Reproduit de la revue *Le Lait*)

Le lactose se trouve dans certains laits en présence de quelques autres sucres réducteurs. Dans des laits altérés et additionnés de bichromate pour être ensuite expertisés, le lactose subit souvent une hydrolyse partielle en glucose et galactose. Dans des laits concentrés sucrés, parfois le saccharose s'invertit légèrement. Il est alors difficile de déterminer exactement la quantité de lactose contenue dans ces laits, pour obtenir une valeur de l'extrait sec total au moyen de tous les éléments dosés séparément.

Pour doser le lactose dans ces liquides sucrés, j'ai employé la liqueur de Barfoed. C'est une solution d'acétate neutre de cuivre dans de l'eau légèrement acidulée par de l'acide acetique (2). Elle a la propriété de n'être pas réduite par les bioses (lactose, maltose), tandis que les monoses (glucose, lévulose, galactose) la réduisent et donnent un précipité d'oxydule de cuivre. En recueillant cet oxydule sur un filtre ordinaire et en déterminant son poids par la méthode volumétrique de M. Gabriel Bertrand, je puis connaître les quantités correspondantes de monoses. Par différence entre la somme des monoses et des bioses déterminés par la liqueur de Fehling et la quantité de monoses ainsi obtenue par la liqueur de Barfoed, je calcule ensuite le chiffre de lactose.

Laits altérés additionnés de bichromate. — Il y a intérêt à distinguer dans ces laits le lactose non hydrolysé de ses produits de dédoublement: glucose et galactose. Les pouvoirs réducteurs de ces deux sucres sont, en effet, supérieurs à celui du lactose anhydre; il peut donc en résulter des erreurs importantes. M. Hildt (3), pour obtenir le chiffre de lactose, conseille de dé-

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(1) C. R. Académie des Sciences, t. 172, p. 602.

(2) Barfoed. — Organische analyse qualitative (Copenhague 1881), p. 221 (une partie d'acétate neutre de cuivre dans 15 parties d'eau dont on prend 200 cc. pour ajouter à ceux-ci 5 cc. d'acide acétique à 38 p.c.).

(3) Hildt.—*Annales de chimie analytique*, T. I, p. 309, 1919.—*Bulletin Société chimique*, T. XXV, p. 617, 1919.

terminer le pouvoir réducteur avant et après l'hydrolyse totale, et calcule en lactose ce qui subsiste des sucres réducteurs. Pour ne pas détruire le glucose et le galactose par suite d'un chauffage prolongé à 100 deg., il préconise l'emploi de catalyseurs comme le phénol ou le benzène-sulfonate de sodium.

La liqueur de Barfoed offre certainement l'avantage de donner immédiatement la quantité de glucose et de galactose, sans avoir recours à une hydrolyse complète du lactose. Si l'on obtient, d'une part, le poids de cuivre précipité dans cette liqueur par des quantités connues de glucose et de galactose mélangées en mêmes proportions, et, d'autre part, si l'on trouve par la liqueur de Fehling combien de glucose correspond au lactose non hydrolysé, on calcule facilement la quantité de lactose anhydre, en multipliant celle-ci par le coefficient: 1,353. Pour plus de facilité, il est nécessaire d'établir une table des poids de cuivre obtenus par des quantités déterminées de glucose et de galactose, dans une solution d'acétate de cuivre à concentration favorable (15 cm³ d'acétate pour 5 cm³ de solution sucrée). J'ai vérifié l'exactitude de cette méthode à l'aide du pouvoir rotatoire, et c'est ainsi que, pour trois échantillons de lait certainement mouillé, j'ai obtenu pour 100 de lait:

	Lactose anhydre			
	Par pouvoir réducteur	Par pouvoir rotatoire	Glucose + galactose	Somme de sucres réducteurs
1er échantillon ..	2.14	2.40	1.53	3.67
2ème échantillon	2.83	2.94	0.69	3.52
3ème échantillon	2.07	2.26	1.93	4.00

Laits concentrés sucrés.—Tous les laits concentrés sucrés ne contiennent pas du sucre inverti provenant du saccharose. Dans un échantillon je n'en ai trouvé que des traces; dans un autre, au contraire, la proportion était assez forte, de sorte qu'il est intéressant de calculer la quantité de sucre inverti non seulement pour contrôler l'extrait sec et la quantité de saccharose primitivement introduite, mais encore pour vérifier une fabrication qui semblerait défectueuse.

Le saccharose s'invertit probablement sous l'influence de l'acidité du lait. En effet, dans du lait très acide (44 deg. Dornic), j'ai ajouté du saccharose, et, pendant une heure, le liquide a été concentré au vide, au bain-marie. Dans ces conditions, une très notable quantité de sucre inverti fut mise en évidence par la liqueur de Barfoed.

La méthode que j'ai indiquée précédemment est la seule qui puisse être employée pour déterminer la quantité de saccharose transformée en sucre inverti. Elle a été vérifiée de nouveau, en comparant la somme algébrique des rotations calculées de tous les sucres à la rotation trouvée:

C'est ainsi que, sur 10 gr. de lait concentré, j'ai obtenu:

Sucres	Poids	Rotations calculées	Rotation trouvée
Sucre inverti	0,36	—0°,10	
Lactose hydraté. .	1,62	+1°,14	
Saccharose. . . .	4,02	+3°,46	
		+4°,60	+4,56

Ce lait concentré, écrémé, a été analysé complètement, et j'ai trouvé pour 100 de lait:

M. grasse	2,00
Lactose	16.20

Sucre inverti	3.60
Saccharose par rotation	40.00
Saccharose par réduction	40.20
M. azotées	9.81
M. minérales	2.30

Pour permettre au lecteur de se rendre compte des difficultés qui se présentent, dans le dosage, les chiffres obtenus par la méthode ordinaire et par celle que je propose, j'ai dressé le tableau ci-dessous:

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(1) Les laits ont été déféqués au bisulfate de mercure, le bisulfate en excès a été précipité par de l'eau de baryte, et la baryte en excès par du CO_2. L'addition d'eau de baryte précipite le chrome et dilue la liqueur à analyser. On évite ainsi la précipitation d'un sel basique, qui se forme toujours par réaction de la liqueur de Barfœd sur une liqueur contenant plus de 1 pour cent de sels alcalins ou alcalino-terreux.

	Chiffres obtenus	
	Sans faire intervenir la liqueur de Barfoed Méthode ordinaire	En faisant intervenir la liqueur de Barfoed Méthode proposée
Saccharose	40.20	40.20
Sucre inverti . (	21.00	16.20
Lactose . . . . . (		3.60
Somme des sucres	61.20	60.00

La liqueur de Barfoed peut donc être employée avec intérêt par les chimistes de la répression des fraudes pour doser quantitativement le lactose, dans les laits altérés, où différents sucres réducteurs se sont formés par hydrolyse, et pour contrôler la fabrication d'un lait concentré sucré.

(Travail fait au laboratoire de M. Lindet, à l'Institut national agronomique.)

En 1870, alors que la population de notre pays n'atteignait pas encore quatre millions, un capital de 78 milions ou de $21,134 par 1,000 habitants etait engage dans l'industrie manufacturière. En 1915, avec une population de huit millions environ, le capital ainsi engagé s'élevait à tout près de deux milliards, soit $247,000 par 1,000 habitants. C'est-à-dire que, alors que la population augmentait de 100 pour cent, le capital engagé dans la seule industrie manufacturière augmentait de 1000 pour cent.

L'œuvre d'un peuple n'est jamais terminée et les générations qui le perpétuent reçoivent chacune une mission nouvelle.

Si la progression numérique est un facteur important dans l'économie d'un peuple, le degré d'instruction ne l'est pas moins.

A l'occasion de Noel et du Nouvel-An, la Revue Agronomique offre à ses lecteurs ses meilleurs souhaits. Elle forme des vœux pour le succès de leurs entreprises, pour la prospérité de la classe agricole et pour la réalisation de l'idéal national.

L'organisation économique est complexe et les forces productrices doivent être maintenues et réparties suivant que l'exigent les capacités et les aptitudes de la nation, et de façon qu'elles s'équilibrent et se complètent.

: : EDITORIAL : :

The statement that the rate of industrial progress is dependent, in a large degree, upon successful research work, is seldom questioned. More and more, and particularly in recent years, the value of the research worker is becoming recognized, and to no industry is this more applicable than to agriculture. Within the past forty years agricultural progress in Canada has been particularly rapid and it is surely significant that these forty years of progress co-incide with the period during which our agricultural colleges have been turning out trained men.

It is true that comparatively few of these graduates have entered the field of research, but it is none the less true that they have played an important part in the agricultural development of this country. Forty years ago the Ontario Agricultural College was turning out its first trained men and if we trace the careers of those graduates, and of the men who followed them, we find that each one filled an important niche. But the supply of trained men was not sufficient. Other agricultural colleges were equipped, the number of trained men increased rapidly and today we find them in almost every community, holding responsible positions in Federal or Provincial service, in commercial life, teaching other students or — more recently — qualifying themselves for more advanced work. Our agricultural colleges are now producing at least 200 trained men each year.

Within the past decade a new development has taken place in agricultural education, namely, the inclination on the part of many graduates to specialize further by taking post-graduate courses. Whether this is a natural inclination, or whether it is the result of keener competition, is debateable; the fact remains that the agencies employing trained men, either for teaching, administration, extension or research work, are apparently recognizing the value of specialization.

And so we find that we are entering a new period — a period of specialists. Until recently the graduates, with Bachelors' degrees, were satisfied to take up professional work and there was a keen demand for their services; today the graduates — if they are able to do so — are in many cases, and in increasing numbers, continuing their studies.

What is going to be the result of this new trend? Will the increased value of the specialist always be appreciated? Will his services be at a premium? Will the qualified research worker be left alone to accomplish results in his own good time and with his judgment, or will he be expected to turn out a certain number of results per year, via the short cut method? And our best men, just when their value to the country is being demonstrated, going to be "grabbed up" by commercial institutions which are willing to pay higher salaries? These questions are all pertinent. It will not be many years before we shall know exactly how fully appreciated is the value of special training.

This country can ill afford to lose the services of men who have proved their worth. Anyone who looks back upon the agricultural development that has taken place within recent years and who then contemplates the tremendous possibilities for further progress, will realize that the demand for specialists will be continous for many years. There are scores of problems requiring investigation and in most cases the solution of those poblems will be of financial, as well as of scientific value to this Dominion. But these problems cannot be quickly solved and can never be solved without the services of experts — in the laboratory and in the field.

The present issue contains two papers that have a particular bearing upon the question of agricultural research, both of which were read before the recent convention of the American Association for

the Advancement of Science. One of these is by Dr. E. W. Allen, Chief of the Office of Experiment Stations at Washington and Editor of the Experiment Station Record, and the other by Dr. J. H. Grisdale, Deputy Minister of Agriculture for Canada. These men, in the performance of their official duties, are in constant touch with trained men and with the results of research work. They may be expected to be fully appreciative of the needs of their respective countries and of the best manner in which those needs may be met.

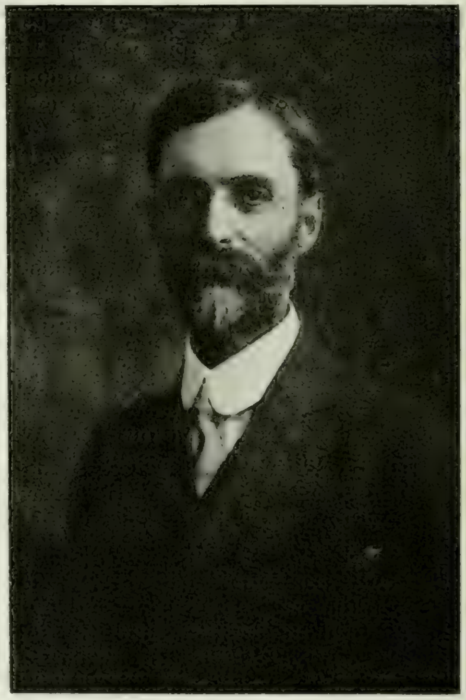
A third paper on the same subject, by Dr. Charles E. Saunders, Dominion Cerealist, is also published in this issue. This paper is of special interest because, in a sense, it constitutes the writer's farewell to Canadian agriculture. Professional workers, not only in Canada but throughout the world, will learn with the deepest regret that Dr. Saunders has recently tendered his resignation to the Dominion Government, to take effect this spring. We understand that his decision is final.

The career of Dr. Saunders since his appointment as Dominion Cerealist in 1903 is one which, while being highly meritorious, has brought little personal reward. This may be the case with research workers in general and, in the present instance, the loss of Dr. Saunders' services may do no more than give emphasis to a lamentable condition, one which perhaps only the force of public opinion can remedy.

Dr. Saunders is a comparatively young man — he was born in 1867 — but during the past twenty years he has given particularly valuable and faithful service to his government. He has never possessed good health and the fact that he has always been active and industrious may be attributed solely to the enthusiasm which so often typfies the unselfish, keen worker. But even one's enthusiasm will wear out unless a certain amount of encouragement is forthcoming. We believe that discouragement is the chief reason for Dr. Saunders' resignation.

The name of Dr. Saunders will always be associated with Marquis wheat, a variety which has increased the revenue of this country by millions of dollars. The first seeds of Marquis were given to Canadian farmers in 1909, and in 1918, at the height of the food shortage, over three hundred million bushels were produced on this continent. Dr. Saunders also discovered and introduced Prelude, Ruby and Early Red Fife wheats, the Liberty (hulless) oat, and other cereals. His work in the breeding and testing of cereals has been of incalculable value.

"Thus is genius rewarded!"



CHARLES E. SAUNDERS
Dominion Cerealist who has tendered his resignation to the Dominion Government.
(Photo through courtesy of World Agriculture).

The Method of Science in Agriculture*

By Dr. E. W. Allen,
Chief, Office of Experiment Stations, U. S. Department of Agriculture.

To be practical has been the great goal of agricultural investigation from the beginning. It was entered upon with a practical purpose, and in a large degree practical results early came to be the expectation of the farming people. Here was a type of science which was not working in the clouds for its own sake, but down in the dirt where the problems of farming lay.

It is fortunate that this has been so—that this close sympathy and this urge to meet the needs of the art have been felt so keenly. It has given life as well as purpose to our branch of science, and the wide extent to which its findings have been embraced and woven into the warp and woof of intelligent practice has been a constant source of stimulation. It makes even more imperative the call for steady progress, not only in getting practical results for immediate use but in securing deeper insight and larger intelligence about the common things of agriculture.

The problems of agricultural science have become increasingly difficult. As the simpler things lying near the surface are gradually solved the underlying problems are seen to be more complex and difficult, taxing knowledge, skill, and imagination to increasing extent. Almost have they come to call for that rare perspicacity of the colored preacher who claimed to be able "to explain the unexplainable, to make known the unknowable, and to unscrew the inscrutable."

At all events, there is no more exacting field of experimental inquiry at the present time, and success in it is largely a matter of methods. It calls for a clear conception of the nature of problems and means for deriving the needed data for their solution. Steady advancement in some of the oldest and most common lines of agricultural inquiry rests more largely on the development of methods than on additional experiments or the accumulation of data on the conventional basis. It is the largest problem in agricultural investigation at the present time, and it is so important that to a large degree it determines the progress of science.

Fundamentally the method of science is the same, of course, in agriculture as in the simple sciences. It makes no difference whether the subject is cornmeal or a chemical compound, the response of the growing plant or the law of falling bodies, the experimental method and requirements for the same grade of inquiry are the same. But in practice different types of effort are represented which vary with respect to their aim and the extent to which they require application of the scientific method. The difference is perhaps chiefly a quantitative one, of degree rather than kind, in conception of the end of inquiry rather than in general essentials which must be met.

In the simpler forms of agricultural work, consisting of observations, tests and trials, the object may be a quite superficial one — the attempt merely to get a bit of information but one step removed from ordinary experience, such as the profit from use of a fertilizer, the larger crop from spraying or the advantage of fall plowing. The information may be quite sufficient for the practical purposes of the time and place but it can not be said to be very scientific even if made with every care, for the work involves no study of exact relationships or tracing of the effect of conditions. In other cases observations, tests and trials may have a deeper purpose and form a step in investigation. Similarly, experiments may be purely comparative, as showing the relative value of different fertilizers, or feeding stuffs or methods of tillage, without touching any basic fact; or they may be the means of securing scientific facts in a piece of fundamental research.

* Paper read before Section O (Agriculture) of the American Association for the Advancement of Science, Toronto, December 28, 1921.

In the early stages of agricultural experimentation, before the problems had been organized to show their nature and content, the work was naturally elementary, based largely on observations, comparative trials and simple experiments which did not attempt to determine the underlying conditions or establish definite relationships. These types of work have given results which although largely empirical have been extremely useful. They have supplied a great fund of information on which to develop practical systems and to base further experimental inquiry. Although sufficient for one stage, they may be a poor means of progress in another. Hence they need to be replaced by more rigorous methods and by investigation which goes to the heart of the problems.

It has been a somewhat prevalent mistake to assume that a complex agricultural problem could be solved in its practical aspects without a study of the principles and factors underlying it. This has led to the attempt to secure quick results by short cuts, and has bred overconfidence in the competence of simple comparative experiments. Reliance upon such time-honored procedure in certain classes of work has resulted in the effort to refine them without going outside of them or bringing to their support more abstract types of inquiry which the changing status of the problems made necessary.

This is not to overlook or to minimize in the least the increasing extent to which agricultural research has advanced into new fields or stages of inquiry, has developed improved methods and means of progress, and has been rewarded with results comparable with those in any line of investigation. Such effort has well illustrated the truth that in this branch of research as in other walks of life "we build the ladder by which we rise;" and it argues for a type of experimental work which is critical of its methods and conclusions, seeking means for strengthening them and avoiding error or uncertainty.

But certain types of work have not been marked by such growth of vision and method, with the result that they have become doubtful means of scientific progress at the present time. They continue to perpetuate their possible errors or inherent limitations after these have been disclosed. They are not fulfilling the expectations originally placed upon them; and while they have been useful up to a certain point, they are accumulating data after they have ceased to shed new light.

The aim of science is simplicity, the dissolution of complexities, and development of simple facts and statements easily comprehended. Its method begins with a simplifying process, — the analysis of problems to get at their real nature and content, the resolution of complex questions into parts which are sufficiently simple and self-contained to be capable of study. Often this can be only partially done at the outset, but as the investigation proceeds and the real nature of the problem is disclosed the segregating process becomes easier.

In agricultural investigation this is difficult because of the many factors embraced, and in the more common types of work with plants and animals it has only been followed to a limited extent. More often the problem has been an involved and complex one from the start, embracing a wide range of phenomena; and instead of being simplified and reduced to smaller definite units as the work progressed it has gathered bulk as it went, like a snow ball, until it has become such a complicated aggregation as to be well-nigh unworkable. Too large for any intimate study, the mechanics and routine of it have occupied the full time and it has often degenerated into the broad accumulation of data.

In constructive research data are secured for use, not for themselves. They are designed for a definite purpose — to solve a concrete problem, to prove or disprove a conception or an idea, to disclose scientific facts. The undirected collection of facts, whether they be observations, results of experiments, or what not, leads to complexity, to an aggregation of data which must first be classified before being used in molding a scientific explanation or a principle, or developing even practical information. Unless there is a clear objective and an idea to guide in

the acquiring of data, it may be a waste of time, an aimless, hopeless, dead effort. Its results may be chaotic, impossible of developing a leading principle or an illuminating fact.

There is still a quite prevalent idea that the ends of research may be satisfied by the accumulation of data. It is a common expression in connection with the status of long-continued experiments that "data are being accumulated". This is especially apt to be the case where such complex conditions and factors are involved that the results from year to year are confusing; and it is assumed that these uncontrolled variables may be eliminated by long repetition. In such cases there is apt to be lack of a critical attitude toward both the method and the data themselves, and hence the test of adequacy or competence is not applied. Data add to the accumulated fund of information when they are accurate, systematic, and orderly, and so capable of enabling deductions or fitting into other supplies which may be so used. Unless they respond to such a test it may well be questioned whether their accumulation is profitable at this stage, when there is already such a large background.

Simplification and definiteness of purpose give direction to the making of records and the gathering of data. All experimental inquiry turns upon securing proof which is both accurate and adequate to the purpose. The method of science is the process of securing accuracy and precision in purposeful observation, and the interpretation of the product. As has been said, it is "only a perfected application of our human resources of observation and reflection."

The method is not a fixed thing but is continually changing as progress makes possible. Science strives constantly after new ways of acquiring and proving facts which would otherwise not be known or but imperfectly so, and at the same time eliminating the personal factor. Apparatus and appliances are designed primarily to make possible the taking of observations which would otherwise not be feasible, or with equal accuracy. They therefore enlarge the field of observation and increase precision.

This applies of course to facilities and methods for agricultural inquiry such as field plats and cylinders, feeding appliances, special apparatus and other means for securing experimental data; and there is the same need of critical examination of these from time to time that there is of other facilities, to determine whether they are supplying proof which is accurate and sufficient, or to assess correctly what can and what can not be shown by such methods.

The question is forcing itself upon the minds of many as to the adequacy of certain types of field experiments, as ordinarily conducted, to answer fundamental questions in plant nutrition and soil management. Large reliance has been placed on such experiments in the past, and data have been accumulated from them over long periods. The oldest series of fertilizer and rotation plats in this country runs back over forty years; several others have been under way from twenty-five to thirty-five years. One station has some two thousand plats.

These experiments have brought highly important practical results, and have marked a definite step in agricultural inquiry. They have furnished a rich background of material and suggestion for more definitely directed studies. The question is whether they have reached their maximum and how far they are to be depended upon in making further advances.

It is now realized that many of these long-time experiments contain inherent difficulties dating back to their beginning which introduce a strong element of doubt in interpreting results. For one thing, most of the published reports fail to describe the soil except in the most general way, and lack information as to the condition and previous treatment of the field indications of irregularity, etc. Again, the number of check plats is usually too small, and the same is true of the amount of replication of treatment. This may account for the different interpretations made by different persons from the same series of experiments. In few cases has the necessary number of checks and duplicates been worked out mathematically for such experiments, and where

there is considerable variation in different parts of a field, averages may furnish a doubtful basis for measuring the effect of treatments.

The number of questions "put to the soil and the plant" in a given plat experiment has usually been far too large. For example, the customary rotation-fertilizer experiment has often covered practically the whole range of soil fertility and plant nutrition. This wide range has limited the amount of replication practicable, and it has failed to reflect the discrimination in gathering data and the simplification of the problem dictated by the method of science.

Such experiments have relied quite largely on what the field results themselves were interpreted to show, primarily the crop returns. True, most of the later experiments have embodied plans for chemical, bacteriological and other laboratory studies, but only to a limited extent have these been developed with the progress of the work so as to shed new light. The chemical studies have often become of a routine nature — analyses of the crops and of the soils at stated intervals, and the bacteriological studies by the technique developed have largely failed to meet expectations in establishing correlations between soil treatment and bacterial flora. Such observations have now almost ceased in connection with these experiments.

Reduced to such a simple collection of experimental data, the conduct of these extensive field experiments has often become largely a matter of routine. The niceties of plat work are observed, but the element of actual inquiry is deferred until many years have supplied their data. When that time is reached the publication is more often a summary of field and laboratory records than a critical analysis of the data and their actual meaning. At best the product is quite apt to consist of empirical observations rather than definite contributions to fundamental principles. We have not yet learned how to interpret except superficially the answer which the soil and the plant give as to just what has happened or to what the apparent effects are due. We have not yet learned how to examine a plat of soil so as to determine the changes occurring from time to time or brought about by a long continued system of treatment, or how to connect these changes with the response of the crop in a given season or period. Indeed, relatively little study is now given in such experiments to the soil itself, and only to a limited extent are underlying questions suggested by such experiments being given intensive study.

In a word, the indications are that in the majority of cases the use is not being made of such long-time field experiments that ought to be made at this stage. They are rarely being simplified as time goes on, with a narrowing down to specific problems for intensive research, and they are not being increasingly supplemented by definitely directed laboratory study. They ought themselves to be progressive both in method and outlook. They ought to be used as the source of problems and material with which to make further and more profound inquiries.

We can hardly fail to recognize the changed status at the present time, both as to practical requirements and the stage which has been reached in research and its problems. What is especially needed at this stage is the study of factors and their relationships, rather than gross comparisons of one complex of conditions with other complexes. This will call for the kind of team work which has been applied to the Rothamsted experiments,—the association of the chemist and the bacteriologist with the agronomist and soil expert, and the guidance of the statistician in both planning and interpretation.

In many of the feeding experiments, also, the unchecked sources of possible error are too great for safety. The small number of animals in the lots gives large chance for the influence of individual variation. The conditions and infrequency of weighing may also give misleading indications. Some of the results of such experiments can be measured quite accurately, while others can only be described. Some are not strictly experimental because they embody so many factors not under experimental control, whose probable variation can not be estimated. This is true of the cost or financial returns in feeding, as Dr. H. H. Mitchell has re-

cently shown. Such results lack permanent value, and are likely to be given a prominence and an application which they are not entitled to.

Experiments of this practical type have been useful in the past and there will be need for them in future. It is important that they occupy their proper place; but in the scheme for investigation they should not take the place of nutrition studies based on more permanent factors than prices and food combinations, or reliance rest too largely on them at this stage.

Many important advancements are being made in animal nutrition which will find application in feeding practice and in showing the reason back of it. These disclose more clearly the functions to be discharged by food, the inherent qualities which account for the observed value or special properties of particular feeds, and the means of measuring the response of the animal with a high degree of accuracy. Such fundamental investigations ought assuredly to be encouraged, not to the exclusion of but along with the type of feeding experiments which seek a more immediately practical end.

The magnificent work of Armsby and his associates has been the admiration of the scientific world, but in spite of its ultimate practical value, and especially in furthering investigation, it had not within itself the elements of publicity, and was only vaguely understood. It never had an assured permanent income, and in that sense was obliged to live from hand to mouth. The loss this entailed is realized too late; and now the future of the work he so admirably started is under consideration. It would be a calamity if it were allowed to fall to the ground.

The large amount of attention now being given to fundamental and searching inquiry on the soil, the conditions of plant growth, and related subjects, should not fail of mention in this connection, for it illustrates the development of insight into these problems. At no period has there been anything comparable to it. The results which are following from these intensive studies amply justify the expectations of them as constructive means of progress.

With all the facts clearly in mind, it is very important to take an account of stock in the more conventional lines of experiment; to study seriously the more extensive and better class of them in order to determine what they have actually shown, what they are competent to show, and the lessons they teach in methods. By all means, let us garner in all the teachings of these field and other common types of experiment; let us profit by both the good and the bad experience, but let not the negative results be overlooked in searching for the more positive ones. Such experiments represent large annual expenditures, and they occupy the time of a large body of workers. They express a confidence on which men are staking their efforts and their prospects. It is important to know the place which such experiments should occupy in future study and the manner in which they need to be supplemented. This may be one of the fundamental lessons to be drawn from them, and may indicate that for purposes of research their most useful field is in supplementing laboratory studies, rather than the reverse as in the past.

In a public supported enterprise like agricultural investigation there must necessarily be a happy combination of effort representing different grades of intensity. Some problems or stages of them call more urgently for the full measure of the method of science than others, and it will be for the investigator to govern himself accordingly. But he can not fail to exercice a critical attitude toward all his work and his methods, or to exemplify in them the element of real progress.

J. H. GRISDALE,
Deputy Minister of Agriculture for Canada, whose address on "Better Co-operation in Research" is published in this issue.

Apple Tree Anthracnose or Black Spot Canker Control

By E. W. WHITE,
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This disease is prevalent in practically all apple orchards of the coast districts of Oregon, Washington and British Columbia, where control measures are not regularly adopted. It is perhaps the most serious fungous disease with which the coast fruit grower has to deal, and during the past twenty-five or thirty years has caused the destruction of a great number of apple trees with corresponding financial loss.

It is not the intention in this paper to discuss the origin or life history of this disease or the proper scientific name by which it should be known, but rather to give briefly the results of five years experimental work in the control of this trouble carried out in the Keating district near Victoria, Vancouver Island, B. C.

In past years the general recommendation given to our growers for the control of this disease was to spray with double strength Bordeaux (8-8-40) as soon as the fruit was picked and before the fall rains commenced. Where this system of spraying was followed out very efficient results were obtained, especially on early varieties of apples, and even on late varieties in a good many cases the disease was held in check where the spraying was done thoroughly.

The trouble with this control measure, however, was not due to the inefficiency of the spray, but to the fact that the harvesting period is always a busy time for fruit growers and in the majority of cases early varieties were not sprayed when the fruit was harvested; by the time the late apples were picked the wet weather had set in and it was often very difficult to get a fine day on which to do the spraying. In consequence infection took place and each year more dead wood could be found in the orchards.

Our growers were becoming discouraged in their efforts to control the disease and were claiming that it could not be done economically and efficiently.

Consequently in the fall of 1916 the Horticultural Branch in co-operation with J. W. Eastham, Provincial Plant Pathologist, decided to do some experimental, or perhaps better, some demonstration spraying.

In outlining the work we were very grateful for information relative to the success achieved in controlling the disease by Leroy Childs, Director of the Hood River Experiment Station, by combining a Bordeaux spray with the last codling moth spray.

It was confidently felt that the disease could be controlled on early apples and for that reason a late variety was chosen with which to work. A block of 36 twenty-year-old Baldwin trees was selected in the orchard of Tanner Bros., Keating. These trees were very badly diseased and the owners had threatened to cut them out on numerous occasions; in fact, the disease was so bad that practically every bit of new wood which grew each year would be girdled by the canker the following spring. Nothing but the bare framework of the tree and innumerable dead shoots were left to constitute the tree. In 1916 the trees were carrying a very light crop of fruit, it being the off-year for bearing.

In planning to apply a weak Bordeaux spray early, while the fruit was still on the tree, it was thought that it would be necessary to wipe the fruit before marketing but this was found to be unnecessary.

The block of trees was laid out in four plots, the first nine trees in each row constituting Plots 1, 2, and 3, and the last three trees in each row constituting Plot 4, or check-plot. Plot 1 received only an early spray of weak Bordeaux 3-4-40. Plot 2 received an early and late spray of weak Bordeaux 3-4-40 and strong Bordeaux 6-6-40. Plot 3 only received the late spray of strong Bordeaux 6-6-40. Plot 4 was the check plot and received nothing.

In 1916 the first spray of 3-4-40 Bordeaux was applied on September 6th, after a very dry summer, to Plots 1 and 2, constituting 18 trees; 80 gallons of spray mixture were used, averaging 4.44 gallons per tree.

The cost of materials and application for the first spraying was as follows:

6 lbs. Copper Sulphate at 0.10 ..	$0.60
8 lbs. Lime at 0.02	0.16
2 nozzle-men, 1 hr. at 0.25 each ..	0.50
Man & team, 1 hr. at $4.00 per day	0.50
Total cost	$1.76

Cost per tree of first aplication, 9.77c, (or roughly ten cents).

Following the application on September 6th, the dry spell continued and practically not a drop of rain fell up to the time the apples were harvested about October 21st. In consequence of this there was a heavy coating of Bordeaux still adhering to the fruit when it was picked. The dry weather also caused a shortage of water and we were unable to carry out our original plan of putting on the second application as soon as the fruit was picked. Rain began to fall on October 25th and continued intermittently until November 8th. On this date the weather was favourable and the second spray of 6-6-40 Bordeaux was applied to Plots 2 and 3; 80 gallons of mixture were made up and there was sufficient to spray 4 trees besides the 18 in Plots 2 and 3, so that the average number of gallons per tree was 3.63.

The cost of materials and aplication for the second spraying was as follows:

12 lbs. Copper Sulphate at 10c.....	1.20
12 lbs. Lime at 2c.	.24
2 nozzle-men, 1 hr. at 25c. each..	.50
Man and team, 1 hr. at $4.00 per day	.50
Total cost	$2.44

Cost per tree of second application. 11.09c

In both sprayings and in the following sprayings a Bean Giant Triplex power-sprayer was used and a pressure between 180-200 lbs. was maintained. The long-distance Friend nozzle was used in all sprayings.

Storing and Packing of Sprayed Apples, 1916.

After the apples were picked on October 21st they were placed in orchard-boxes in ordinary shed storage and held until the first week in February, 1917. They were then packed and sold locally. The crop averaged one half box per tree.

It was found that when packing was commenced practically no sign of the Bordeaux mixture could be found, except very occasionally in the calyx or stem end of the apple, and it was thus unnecessary to wipe the fruit. However, the surface of the apples was left in a very sticky condition and it was almost impossible to wipe the fruit unless it was first washed. No complaint was received in reference to the apples after they were sold.

Figure 1. — Branch of apple tree showing type of anthracnose canker.

Counts of Infection, 1917.

On May 25th J. W. Eastham, Plant Pathologist, made the counts for infection on the plots with the following results:

Plot 1, early spray, 270 one and two-year-old branches examined from 5 trees, and 31 were found to be infected, or 11.4 per cent.

Plot 2, early and late spray, 375 one and two-year-old branches examined from 5 trees and 27 were infected, or 7.2 per cent.

Plot 3, late spray only, 326 one and two-year-old branches examined from 5 trees and 251 were infected, or 76.99 per cent.

Plot 4, check-plot, showed practically 100 per cent infection.

It will be seen by this that even the spraying the first year showed marked results. The late spray did some good, but nothing in comparison with the early and the early and late spray.

In 1917 the experiment was continued on exactly the same lines as in the preceding year.

The early spray of 3-4-40 Bordeaux was applied to Plots 1 and 2 on September 1st. Eighty gallons of mixture were necessary for the 18 trees, or an average of 4.44 gallons per tree.

The cost of materials and application for the first spray was as follows:

Copper Sulphate, 6 lbs. at 24c.	1.44
Lime, 8 lbs, at 2c.	.16
2 nozzle-men 1 hr. at 30c. each	.60
Man and team, 1 hr. at $5 per day	.62½
Total cost	$2.82½

Cost per tree for the first application 15.7c

September continued fine and dry, but commencing on October 1st considerable rain fell at intervals up to October 27th-29th, when the apples were harvested. The crop averaged 5½ boxes per tree and was the best crop harvested from the same trees for years.

There was plenty of water available for spraying, due to the rains during October, and the second spraying of 6-6-40 Bordeaux to Plots 2 and 3 was made on October 30th.

The cost of materials and application for the second spray was as follows:—

Copper Sulphate, 12 lbs. at 24c.	2.88
Lime, 12 lbs. at 2c.	.24
2 nozzle-men, 1 hr. at 30c each	.60
Man and team, 1 hr. at $5 per day.	.62½
Total cost	$4.34½

Cost per tree for second application 24.1c

It will be seen that the cost per tree in 1917 was considerably in excess of 1916, due entirely to the increased cost of material and labour. Even 15½ cents per tree for the first spray is not excessive. It would take a very small increase in crop to overcome that expense.

Storing and Packing of Sprayed Apples, 1917.

Our experience of 1916 was repeated in 1917, and when the apples were packed up early in January, 1918, it was found that the spray had practically all disappeared.

Due to the wet weather during October, however, the unsprayed apples showed a very heavy infection of rot in the fruit, while the fruit which was sprayed was practically 100 per cent. clean and held up much better in storage.

Counts of Infection, 1918.

On May 14th, 1918, Mr. Eastham again made the counts for infection on the plots.

Plot 1, early spray, 6 trees were examined, which only showed a total of 13 cankers, on the one and two-year-old wood, or an average of 2 1-6 cankers per tree.

Plot 2, early and late spray, 5 trees were examined, on which a total of only 7 cankers could be found or an average of 1 2-5 cankers per tree.

Plot 3, late spray, 5 trees were examined, which showed a total of 52 cankers or an average of 10 2-5 cankers per tree.

Plot 4, check-plot, one unsprayed tree was examined which showed 53 cankers, the accessible area of the tree not being all examined.

In 1918 the experiment was continued as in 1916 and 1917. The early spray of 3-4-40 Bordeaux was applied on September 17th. The new wood had so increased that it required 90 gallons of spray mixture for the 18 trees in Plots 1 and 2, or an average of 5 gallons per tree.

The cost of materials and application for the first spray was as follows:

Copper Sulphate, 6¾ lbs. at 19c.	1.28½
Lime, 9 lbs. at 2c.	.18
2 nozzle-men, 1 hr. at 40c. each	.80
Man and team, 1 hr. at $6.50 per day	.81¼
Total cost	$3.07½

Cost per tree for the first spray.. 17.1c

September and October continued very dry, which hastened the maturity of the apples, which were all harvested on October 23rd. The crop was considerably lighter than in 1917, averaging about 4 boxes per tree, it being the off-year for bearing. It was so dry during September and October that when the apples were

harvested there was no water available for spraying, and a few days later it started to rain, and it was not until November 11th that a suitable day occurred, and despite the fact that this was Armistice Day, we made the application, because we were not calling any armistice with the canker, even though we had it beaten.

The cost of materials and application for the second spray was as follows:

Copper Sulphate, 12 lbs. at 19c... 2.28
Lime, 12 lbs. at 2c. 24
2 nozzle-men, 1 hr. at 40c. each 80
Man and team, 1 hr. at $6.50 per day .81¼
Total cost $4.13¼
Cost per tree for second application 22.95c

The cost of copper sulphate was a little less in 1918 than in 1917, but labour increased in price, so that the cost per tree was about the same.

Storing and Packing of Sprayed Apples, 1918.

Our previous experience was repeated in 1918. The apples were packed up late in December and it was unnecessary to wipe the fruit. The sprayed apples again showed remarkable superiority in keeping qualities and in freedom from rot-infection in the fruit.

Counts of Infection, 1919.

On May 29th, 1919. Mr. Eastham again made the counts on the trees.

Plot 1, early spray, all 9 trees were examined and only showed a total of 13 cankers, or 1 4-9 per tree; 3 trees out of the 9 showed no infection at all.

Plot 2, early and late spray, all 9 trees were examined and only showed a total of 6 cankers, or 2-3 of a canker per tree; 5 trees out of the 9 were absolutely clean.

Plot 3, late spray, all 9 trees were examined and only showed a total of 130 or 14 4-9 per tree.

Plot 4, check-plot, one tree examined showed 49 cankers.

Although our work on this plot really ceased with the counts made in May 1919, it is very interesting to note that the crop in the fall of 1919 averaged slightly over 9 boxes to the tree. This increase is attributed almost entirely to the new bearing wood which had been developed in the trees in the previous three years.

Summary.

In summing up the results of the first three years' work the following conclusions were reached:

(1) An early spray is essential.

(2) A weak Bordeaux will do the work if applied early enough.

(3) The cost for the early spray for the three years was only 14.19 cents per tree.

(4) The cost for the early spray is higher than it need be, because material was at war prices and bought in small quantities.

(5) Early varieties may be picked before it is necessary to spray.

(6) It was found unnecessary to wipe the fruit.

(7) Fruit was left sticky, but no complaints were received when it was put on the market.

(8) Covering of Bordeaux did not interfere with colouring of fruit; it seemed to improve it.

(9) Anthracnose rot-infection on the fruit was controlled practically 100 per cent. Keeping qualities were also improved.

(10) The disease can be controlled if growers will only carry out the spraying systematically each year.

Fig. 2.—Apple Tree badly attacked by Anthracnose. Note cankers on main trunk and branches and dead shoots of last year's growth.

In the Fall of 1919 another series of experiments was outlined, as it was desired to test the effect of an early application of 3-4-40 Bordeaux to the King apple, a variety most largely grown on Vancouver

Island, and one which is ready for market about the end of September.

It was also desired to test the effectiveness of Burgundy mixture (1 lb. Bluestone, 1½ lbs. Washing Soda, and 40 gals. water) as an early spray and also a fall application of 1 to 9 Lime-sulphur after the fruit was picked.

An acre of 14-yr. old Kings consisting of 45 trees was selected in Stewart Bros. orchard, Keating, and this was divided into 5 plots of 9 trees each with one tree in each plot left as a check.

This block of Kings had been bearing very consistently up to about 12 years of age but in the 13th and 14th year it had gone back very rapidly and when it was taken over practically every terminal growth was dead. An endeavour was made to count the infection on the one and two-year-old wood on each tree before the plots were sprayed and this count showed an average of 88 cankers per tree over the entire 45 trees. This count was much below the real infection because the following May the count made on the five check trees by Mr. Eastham showed an average of 106 cankers per tree on one and two-year-old wood.

The first week of September 1919 was wet and it was not until September 12th that plot 1 was sprayed with 3-4-40 Bordeaux and plot 2 was sprayed with 1-1½-40 Burgundy.

On Nov. 6th plot 3 was sprayed with 3-4-40 Bordeaux and plot 4 was sprayed with 6-6-40 Bordeaux. The next day, Nov. 7th, plot 5 was sprayed with 1 to 9 Lime-sulphur.

When the fruit was harvested it was found difficult to wipe off the coating of Bordeaux from the apples of Plot 1 so that they could be harvested immediately. However, the apples from Plot 2 which was sprayed with Burgundy showed practically no deposit at all.

Early in the spring the trees were given quite a heavy pruning and an endeavor was made to cut out all dead wood. The trees all had the same treatment so that the counts of infection made later would be on a uniform basis.

On May 11th and 12th, 1920, the counts were made and showed the following results:—

Plot 1, sprayed with 3-4-40 Bordeaux, on the 12th September, 1919, 3 trees showed an average of 9 cankers per tree; check tree 75.

Plot 2, sprayed with 1-1½-40 Burgundy mixture, on the 12th September, 1919, 3 trees showed an average of 33 cankers per tree; check tree 125.

Plot 3, sprayed with 3-4-40 Bordeaux on Nov. 6th, 1919, after the fruit was picked, 3 trees showed an average of 42 cankers per tree; check tree 101.

Plot 4, sprayed with 6-6-40 Bordeaux on Nov. 6th, 1919, after the fruit was picked, 3 trees showed an average of 32 cankers per tree; check tree 140.

Plot 5, sprayed with 1 to 9 Lime-sulphur on Nov. 7th, 1919, after the fruit was picked, 3 trees showed an average of 37 cankers per tree; check tree 92.

In the fall of 1920 the experiment was continued but along slightly different lines. As will be remembered, the fall and winter of 1920-21 was one of the wettest on record. The first rains came on August 28th and they were very heavy. This caught us unawares but the weather cleared and on September 3rd we sprayed Plot 1 with 3-4-40 Bordeaux and Plots 2, 3, and 4 with 1-1½-40 Burgundy. Heavy rains came soon after and they were excessive during the fall and winter.

On October 19th a suitable day presented itself on which to make the second spraying.

Plot 3 was sprayed with 3-4-40 Bordeaux.

Plot 4 was sprayed with 6-6-40 Bordeaux and Plot 5 was sprayed with 1 to 9 Lime-sulphur.

The crop in 1920 in common with the apple crop in general was very light.

There was practically no winter pruning to do in the spring of 1921 but the trees had made a fine lot of new growth during 1920.

The counts made on June 1st, 1921 showed the following results:—

Plot 1, sprayed with 3-4-40 Bordeaux on 3rd Sept. 4 trees showed 4 cankers or an average of 1 canker per tree; one tree had none. Check tree, 12 cankers.

Plot 2, sprayed with 1-1½-40 Bungundy on 3rd Sept. 3 trees showed 5 cankers or an average of 1 2-3 per tree. Check tree, 9 cankers.

Plot 3, sprayed with 1-1½-40 Burgundy on 3rd Sept. and with 3-4-40 Bordeaux on October 19th, after the fruit was picked, 4 trees showed 2 cankers or an average of ½ a canker per tree; 2 of these trees were absolutely clean. Check tree, 4 cankers.

Plot 4, sprayed with 1-1½-40 Burgundy on 3rd Sept. and with 6-6-40 Bordeaux on October 19th. The 3 trees examined were absolutely clean. It is interesting to note that these same 3 trees the previous year showed an average of 32 cankers per tree. Check tree, 17 cankers.

Plot 5, sprayed with 1-9 Lime-sulphur on October 19th, 4 trees showed 23 cankers or an average of 5¾ per tree. Check tree, 11 cankers.

Method of Control.

From the results of the experiments of the past years the following recommendations for the control of apple-tree Anthracnose are being made:

During July and August an endeavor should be made to go through the orchard and cut out all signs of dead wood.

On early varieties such as Yellow Transparent, Duchess, Wealthy and Gravenstein, spray with 3-4-40 Bordeaux as soon as the fruit is picked and before the Fall rains come. This spray is all that is necessary.

On varieties such as King and Jonathan it is advised to spray the last week in August with 1-1½-40 Burgundy and to follow this with a 3-4-40 Bordeaux as soon as the fruit is picked.

On late varieties such as Baldwin and Spy, which will not be harvested until the end of October and not marketed until January, it is advised to spray these the last week in August with a 3-4-40 Bordeaux and this will be all that is necessary.

The use of Burgundy for varieties such as King and Jonathan is recommended due to the fact that this spray gives very efficient results and leaves no deposit on the fruit which will be harvested probably in October.

It is felt that this disease can be almost absolutely controlled if growers will only take the matter in hand, and an endeavor is being made on Vancouver Island to eradicate apple-tree Antrachnose from the orchard.

Fig. 3.—Portion of Experimental Plot of Baldwins, Tanner Bros. orchard, May, 1919, after three years work. In 1916 the trees were very similar to that illustrated in Fig. 2.

Better Co-operation in Agricultural Research Between the United States and Canada*

By Dr. J. H. Grisdale,
Deputy Minister of Agriculture for Canada.

It has fallen to my lot to prepare this paper through force of circumstances rather than on account of any special fitness on my part to deal with the question. I happen to be the administrative head of an organization, the Canadian Federal Department of Agriculture, that includes among its personnel more research workers in Agriculture than are to be found in any other organization in the Dominion. I reluctantly, therefore, agreed to do the best I could to deal with the subject and as a first step to that end, wrote to a great many of the men interested in a practical or administrative way in such work, as many of the members here know.

In reply to these letters asking for suggestions as to how co-operation might best be secured between the workers in the two countries, I have received many answers, some replete with suggestions and most interesting, others of lesser value, but all bearing evidence that the problem of co-operation in research in Agriculture is receiving more or less attention from practically everyone who is interested in research at all.

It is not my intention to attempt to give credit, item by item, to the different gentlemen whose suggestions I may incorporate in this brief paper, for the reasons that in practically no case did any one correspondent seem to have a monopoly of an idea and in no case do I think I have accepted any idea exactly as presented; hence, any attempt to give credit would lead to interminable explanations and references.

In the first place let us consider what is meant by co-operation. The dictionary defines co-operation as "joint action or a working together." It should not necessarily mean, however, a working together on the same phase of the same problem, for, as we all know, there is scarcely a problem now receiving any attention from investigators that may not be worked at from various angles and of which there are not various phases, any one of which might well receive the attention of several investigators.

Now accepting this as the true meaning of co-operation, the great majority of investigators from whom replies were received, were strongly in favour of more and closer co-operation and seemed to think that many advantages were likely to accrue therefrom to both Canada and the United States as countries, and to science generally. It must be stated however, that two or three have expressed the view that co-operation was not practicable for various reasons, of which probably the most common was jealousy or the fear, on the part of workers, that full credit would not be theirs, even when undoubtedly due them.

It is not many years since research in agriculture was begun on this continent. Nevertheless the number of men now engaged in a close study of the various problems, directly or indirectly affecting farmers in America, is quite startling. Progress has, however, seemed slow, not because there has not been much done but because each step forward has opened up a vista of problems apparently interminable and many of them of what were considered as the great basic problems of the industry a few years ago. It is this ever increasing array of problems, many of them of a most complex and difficult character, demanding investigation from various angles and of their various phases at one and the same time, that would seem to make co-operation among and between the workers in these two great agricultural countries more and more advisable, if in fact

* Paper read before Section O (Agriculture) of the American Association for the Advancement of Science, Toronto, December 28, 1921.

not absolutely imperative as time moves on.

The United States Federal Government spent nearly 35 million dollars in connection with agriculture in 1920 and the same year the expenditure of the Federal Department of Agriculture in Canada was about six million dollars. Besides these large sums, the different states and provinces spent large amounts for agricultural education and for research in agriculture. In spite of all this expenditure, however, as I have already said, progress toward the solution of many pressing problems seems very slow.

Now in the fifteen states bordering on Canada there is to be found almost one-half of the whole population of the United States, or well on to 50 million people. These same states produced agricultural products in 1920 to the value of nearly four billion dollars or over one-third of the whole agricultural output of the Republic.

Practically every province in Canada borders on the United States, hence her population, of say nine million, and her agricultural output of about two and a half billion dollars, live or are produced, under conditions very similar to those which maintain in the fifteen northern states It would seem evident, therefore, that our research problems must be practically identical. It is certain that many of them cannot be solved without the research work on either side of the line being extended into the other country. In view of all these facts it would seem to me quite evident that co-operation in work among our agricultural research workers was every strongly indicated In fact, one might almost say that there was no alternative.

That investigations must be limited by crop areas and not by geographical lines, whether these lines be between states or provinces or be international in character, is a statement that can scarce be criticised, let alone refuted. This, of course, is recognized and already there is some of what might be called private co-operation going on in various lines, as will be mentioned later.

The necessity for co-operation was recognized in Canada many years ago in so far as work within her own boundaries was concerned, and the Dominion Experimental Farms System was established in 1886. This system has expanded tremendously in the thirty odd years of its life and bids fair to grow still further. A more recent effort along this line in Canada, and one not confined to agricultural research, has been the Honorary Advisory Council for Scientific and Industrial Research. This body has not been very active recently but is probably susceptible of stimulation into more effective activity.

In the United States also there was organized some time ago, I believe, a body known as the National Research Council dealing almost exclusively with agricultural or cognate problems.. I am not sufficiently familiar with the workings of this Council or the results it has to show to venture any remarks as to either its past achievements or its future prospects. There is also, I understand, an Assistant now attached to the Secretary for Agriculture at Washington whose duty it is to further, if not in fact compel, co-operation in the federal work, and whose field, it is anticipated, will include the activities of the land grant colleges and stations in the near future. The fact that such a Council was organized in the United States and that such an official is now attached to the office of the Secretary for Agriculture would seem to indicate that the need for co-operation is keenly appreciated in the United States, and that at least some steps have been taken to secure it where necessary or practicable.

It would seem reasonable then that since these two adjoining countries recognize the need for such action within their own boundaries, they should give the matter of co-operation between the countries at least more than a passing glance. There are, of course, some objectionable features in conection with co-operation, whether it be international, interstate or inter-institutional in character. Some of these objections have been voiced in some of the letters received in reply to my request for an expression of the views of certain interested parties as already mentioned.

Summarized they were:

1. Where some such steps had already been taken there was no great evidence of any desire to co-operate or to continue co-operation once begun, but rather the reverse.

2. A lack of funds for carrying on research work already under way, hence the impossibility of starting new co-operative work where an appeal to local or state patriotism to secure funds would not be practicable.

3. The fear that such co-operation would run crosswise of institutional organization.

4. The fear among research men that they would lose some of the credit due them.

5. The objection of scientists to having their work subjected to criticism before publication as well as the consequent possibility of delay and possible rejection.

It must be remembered, however, as already stated, that the very great majority of those writing me on this subject, all but two or three in fact, expressed themselves as being strongly in favour of co-operation, hence we may, I take it, proceed with the further discussion of the question.

It would be unwise, within the limits of this short paper, to try even to outline in any detail the many and various problems in the attempted solution of which better co-operation between the research workers in these two countries would seem to be advisable. It would, however, be just as great a mistake, I believe, to omit the mention of some of the more pressing if any further attention is to be paid to the matter at all.

A very great variety of such problems has been suggested to me, or occurs to me from my own experience. Let me mention a few with brief comment in odd cases.

I have arranged them alphabetically:

1. ANIMAL DISEASES as
   - Abortion, contagious
   - Animal parasites
   - Swamp Fever
   - Tuberculosis
2. BEES as
   - Breeding for improvement of species.
   - Disease control.
3. CEREALS as
   - (a) Test of varieties for
     - Hardiness,
     - Earliness,
     - Disease resistance
     - Quality
     - Yield
     - Type of soil for which suited.
     - Climatic conditions for which suited. . . .
   - (b) Breeding.
     - To produce varieties excelling in one or more of the characteristics just mentioned.
4. CHEMICAL as
   - Alkilinity of soils
     and nomenclature in soil anlaysis.
   - Standardization of methods.
   - Soil Reclamation
   - Soil Survey
   - Fertilizers, crop and soil requirements.
   - Standardization of analytical methods of fertilizers and standardization of fertilizers generally.
5. CROP ESTIMATING as
   - Statistics
   - Statistical methods.
6. CULTURAL PROBLEMS as
   - Crop Rotation
   - Soil Drifting
   - Moisture Conservation
   - Green Manuring
7. ENTOMOLOGICAL SUBJECTS as
   - Bark Beetle Control (B.C. and Wash.)
   - Brown Tail Moth.
   - Cut Worms
   - European Corn Borer
   - Grass Hoppers
   - Migratory Birds
   - Spruce Bud Worm (N.B. and Me.)
   - etc.
8. FARM ECONOMICS as
   - Costs of Crop Production
   - Farm Equipment
   - Standards of quality
   - Farm Management
   - Marketing
9. FLAX as
   - Breeding new varieties.
   - Handling and retting.

10. FORESTRY as
    Forest Fire Control Methods
    Soil Survey phase for determination of areas suitable for reforestation.
    Dendrological Studies.
    Timber Conservation.
    Timber Standardization.

11. FRUITS as
    (a) Tests for
    Yield
    Disease susceptibility
    Quality
    Colour
    Winter Hardiness.
    (b) Breeding for improvement in these characteristics.

12. IRRIGATION, study of
    Duty of Water
    Soil Reclamation methods
    Effects on Soil Alkilinity.

13. LEGISLATION IN ANIMAL and PLANT DISEASE CONTROL.

14. LIVE STOCK as
    Breeding Problems
    Feeding Methods
    Food Values
    Vitamines
    Marketing Methods.

15. METEOROLOGICAL OBSERVATIONS.

With more exact correlation of weather conditions with crop growth and farm operations, and the more efficient or economical adaption of crops to soil and climatic conditions.

The Office of Dry Land Agriculture of Bureau of Plant Industry is studying influence of climate in Crop Production at 14 Stations in 7 States from Texas to North Dakota. This should extend to Manitoba, Saskatchewan and Alberta.

16. PLANT DISEASES as
    Anthracnose in beans.
    Root Rots of Cereals.
    Smuts of Cereals.
    White Pine Blister Rust.
    Western Apple Mildew (B. C., Wash.)

In the case of Wheat Rust some co-operative work has been done already between Messrs. Stakman at St. Paul and Fraser at Saskatoon.

There remains, however, much to be done, since this is a disease that must be controlled in these countries if we are to continue to grow wheat. We need a study of the Epidemiology of this disease. That means co-operation from Texas to Northern Saskatchewan.

It would be very advantageous for farmers in the North to be early advised of the probability of a serious rust epidemic any given season, as based on conditions in the South where the rust starts very early in the year, provided of course, that conditions in the North should prove to be favorable to rust development.

The same Biologic Specialization is necessary to develop disease or rust resistant strains.

Further, Cultural Condition tests are needed over wide areas to study the influence of cultural methods on rust.

Then there is the question of Oat Rust in the East.

The question of the possibility of the destruction of the intermediate host plants of the wheat rust, barberry in the west, and of the oat rust, buckthorn in the east, is surely worthy of careful consideration in an international way.

In short, there is room and need in the study of this great problem for the co-operation of all the capable plant pathologists, plant breeders, plant physiologists, biochemists and agronomists in both countries.

17. PLANT BREEDING as
    Genetics
    Soil and Climatic influences.

18. PLANT PHYSIOLOGY

Problems are the same on both sides of the international boundary in many regions.

19. PLANT QUARANTINE.

This is hardly in the class of re-

search problems but co-operation is highly desirable. .

20. POTATOES as
Study of means of transmission and control of diseases of the Potato. This is an Eastern problem and work is being done in N.B., P.E.I., N.S. and Maine on
Leaf Roll
Mosaic
Black leg
Root Rot

21. SEEDS as
Grain Grading
Grass and Clover seed production
Quality of Seeds
Seed Testing and Grading
and

22. TOBACCO as
Curing methods
Breeding for improved varieties.

Now it seems to me that co-operation in research, if it is to have any chance to succeed either as to tangible results or as to duration and development, must be organized and encouraged and the results co-ordinated by some body of men chosen for this very purpose. Such a body or board might, I think, legitimately be called, "The International Research Council." Its chairman should probably be a salaried official ultimately, although not necessarily such to begin with. Its secretary would necessarily be a paid official, while the other members of the board might be expected to give their services gratuitously or rather to take some of the time from their regular duties and while receiving their regular salaries to do the necessary work. Such a board would, it seems to me, need to include several groups or sections in order to insure its work being done efficiently.

As among its duties I might suggest:

1. Deciding on problems to be dealt with and preparing a list thereof.

2. Inviting co-operation and suggesting to workers that co-operation on such and such a problem with such and such other workers might be advisable.

3. Inviting principal men interested in any given line to discuss with them the problems proposed for co-operation in that line. At such a conference or in such discussion would naturally be outlined the work the different workers would be expected to carry on.

4. Arranging to keep workers in touch with each other and with each others work.

5. Serving as a bureau for recording progress and arranging for co-ordination of results.

6. Arranging for publication in one or both countries.

7. Standardizing research methods.

8. Standardizing in some measure at least educational requirements for research men.

9. Arranging for comprehensive monographs on various subjects.

10. Keeping in close touch with national and regional organizations interested in the problems being worked on, as for instance:

American Ass'n. of Economic Entomologists.

Western Agronomists.

11. Encouraging the individual investigator to show his individualty.

12. Encouraging the organization of regional or local organizations for the study of various local problems, as

Great Plains Section of American Horticultural Society.

13. Encouraging, and if possible arranging for interchange of students and institutional workers.

14. Arranging where necessary for the financing of the board and of such projects as seem to be outside the field of any salaried worker willing or able to cooperate.

I have condensed my remarks to the verge of abruptness, for, as I need scarcely remark, this question of co-operation in research is one in favour if which interminable arguments might be advanced with endless data in support. There is I am sure, not a scientist in attendance at these meetings who could not on the spur of the moment enlarge upon the possibilities or advantages of co-operation in connection with the solution of one or another of the many problems now confronting us in these two countries, and as I have stated, judging by letters I have received, workers are all but unanimous in approval of co-operation along some line or another.

Scientific Research in Agriculture*

By CHAS. E. SAUNDERS, Ph.D., LL.D., Dominion Cerealist.

It was a very keen disappointment indeed to me to find that I should be unable to be present at the Agricultural Societies' Convention in Winnipeg. Sure of a cordial welcome, such as you have always given me, I was most anxious to present for your consideration certain important facts in regard to the condition of Scientific Research in Agriculture and to explain what must be done in order to put it on a proper basis and to give it reasonable encouragement. So unwilling am I to lose entirely this opportunity that I venture to send in written form some of the principal thoughts which I wish you to consider. I feel that I can express myself frankly to you not only because of your friendliness but also because of the happy combination which exists in you of western energy with eastern thoughtfulness. You will listen patiently I am sure and if my statements convince you some good results will follow.

There is also a special reason why I ask for your kind attention on this occasion to what I have to say. My remarks may be considered as a valedictory message; for I have decided to give up Agricultural Research work altogether on account of the profound discouragements of recent years, which have at last exhausted my buoyancy and enthusiasm and have begun to affect my health also. The conditions under which I have worked have been growing steadily less and less favourable for a long time. My best efforts to bring about improvements have been fruitless, so that at last I find myself with no choice but to retire from my position.

I ask your pardon for introducing so much personal matter. I feel however, that without some reference to my own case I cannot make you realise the actual position of Scientific Research in Agriculture in Canada to-day. To say that research work is being sadly neglected is putting it very mildly. It is quite true that some brilliant results have been produced in the past quarter of a century, and yet it seems that the more these results are talked about the less is actually done to encourage further work. Not only so, but new handicaps are constantly being imposed, so that the rate of progress has become slower and slower, the outlook more and more gloomy, until at last conditions have been produced which, in some cases at least, are almost heart-breaking.

The purpose of my message to you, however, is not primarily to emphasise the gloominess of the present situation but rather to explain clearly the steps that must be taken in order that, at some time in the future, Agricultural Research may be established on a proper basis.

Who is to blame for the present state of affairs? It is due chiefly to ignorance on the part of the people and on the part of their rulers. Scientific research is not understood, naturally therefore the conditions under which alone it can be carried on successfully are not provided. Practically no attention is paid to the voice of the scientists, the only men competent to speak, and so the same old blunders are repeated again and again and matters go from bad to worse. In a democracy the people govern. Waters cannot rise higher than their source; governments dare not. One may not altogether agree with the writer who recently said "Democracy has achieved its perfect work and has now reduced all mankind to a dead level of incapacity" but there is a distressing amount of truth in the statement. Even when those at the head of affairs have more than average capacity and are men of education and intelligence, they dare not always do what they know to be best for fear of being misunderstood and losing the support of the public. The situation (in regard to Scientific Research) is rendered particularly difficult because of the fatal demands which Democracy makes. It must have results (such as it can understand), it must have efficiency (as it interprets the term) it must have co-operation and co-ordination of effort. Everything must be systematised and everyone must account satisfactorily to the government, and thus to the people,

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*Read, in Dr. Saunders' absence, at the Convention of Manitoba Agricultural Societies, Winnipeg, January 25, 1922.

for all that he does. Scientific research will flourish under such conditions just as a plant flourishes in a dark cellar. It may live, it may even grow to be tall but it can bear no fruit.

What must be done to properly establish and to adequately encourage Agricultural Research?

First of all you must engage the best and most highly trained men obtainable. The second best are *not* good enough. They must be men worthy of confidence, men whose opinions you will accept. You must have the strongest minds, minds that have been prepared for their work by many years of training in the best universities. Probing into the secrets of Nature is not a child's task.

Obviously these men must be adequately paid. A cheap man is useless, and a small salary is an insult to a competent one. I do not mean that a research specialist must be paid as much as a base-ball player, the chief cook in a hotel or a cinema clown. But he should receive a salary large enough to ensure freedom from financial worry, to enable him to give a university education to his children and to spare his wife from having to wear herself out working like a slave.

Next, you must provide conditions under which your research specialist can accomplish something. Remember that he is not working for his salary but for the sake of what he can achieve. He does not keep his eye on the clock; he does not care what time it is, and he resents it bitterly if you ask him to keep track of the time. What he cares about *vitally* is the progress he is making. He wants a proper laboratory, not a makeshift, he wants suitable land and he wants trained assistants. Certain kinds of assistants are easy to obtain, but the highly-trained assistant who has caught the spirit of research is very rare in Canada. He is however, precisely the man your research specialist wants and *must have* if he is to carry on his work on a fairly large scale.

And now I come to the last, the least obvious, and yet the most important point of all. Having obtained a good man, paid him a fair salary, provided him with assistants, laboratories and land, there is one other absolutely essential condition to be fulfilled. *You must trust him and leave him in peace.*

Here is where Democracy rebels and ignorance protests. "But having hired him surely we have a right to keep track of his daily output, to see that he is regularly at work and that he issues periodical reports — preferably on stereotyped forms. Our efficiency expert says this is essential and that we must stand firm." If the efficiency expert knew anything about research he would cease to make recommendations. I am personally familiar with the blighting effects of his touch when he undertakes to regulate and improve research work. I know the loss of self-respect and enthusiasm that inevitably result when an official in a high position, where he should be respected and trusted, is required to sign the daily attendance book in order to entitle himself to a miserably inadequate salary cheque at the end of the month.

Research is a spiritual problem, not a problem in manual labour, and the results of ignorant interference are fatal.

You must not allow the partial truth to obscure the greater one when you say that you hire and pay the research worker. There is one vital element about the man on which his success mainly depends — his enthusiasm. You do not hire this or pay for it. It is not for sale. It cannot be measured or estimated. He will use it lavishly for your benefit, if you treat him properly; but if you put annoying restrictions on him his enthusiasm will perish. All that you can do is to provide favourable conditions and then leave him alone — or else you can kill his enthusiasm by stupid interference.

Do not fear lest your research specialist may waste his time. A long and arduous university training is not taken by indolent people. There are much easier ways of being lazy than that. If your research worker cannot be trusted, dismiss him and engage a superior man. Don't control or fetter him, for by so doing you will certainly bring disaster.

This is the end of my argument. Let me sum up. Scientific Research in Agriculture in Canada is to-day in a deplorable condition. It is much talked about but to very little purpose, for it is not being encouraged. On the contrary, conditions are becoming worse rather than better. We need superior men, men of longer train-

ing, patient, skilful, far-seeing, enthusiastic. We must give these men, when they can be found, all possible encouragement in the way of assistants, laboratories, adequate salaries and freedom in their work. We must respect them and trust them and demand no proofs of so-called efficiency. We must encourage silence rather than loquacity and never permit the publication of reports other than those which the research men — the only competent judges — deem necessary. The public must learn to wait. Only under such conditions can we look forward to some day reaping a harvest from the glorious possibilities which the future holds for Agricultural Research.

I ask you to accept what I have said as the earnest convictions which have come from 23 years of experience in scientific research under university and government control. No one is infallible. I ask for respect for my views only in such measure as my training and experience may warrant. If others who are better qualified to speak differ from me, then you must accept their ideas rather than mine. But I beg of you not to reject my opinions in favor of those of anyone else who lacks that measure of authority which personal experience alone can give.

I appeal to you, as the leading agriculturists of Manitoba, to support every movement looking towards the establishment of Agricultural Research on a right basis. Let the enlightened public opinion of this province lead the way, encouraging the Dominion and provincial governments so that something may soon be done to remedy the evils of the present situation.

I have tried for years, though without success, to do something for the cause. Possibly however now, at the end, my resignation may serve a good purpose in calling attention to the necessity of raising the status of research specialists in order to encourage and retain experienced men. I shall leave my work with regret and yet I am happy in the thought that I shall be relieved of the unfairly heavy burdens which I have carried too long. I am confident also that I shall find some other sphere of usefulness where — within the limitations of my strength — I can be of service to my fellows, in a less conspicuous but perhaps more effective way than heretofore.

And now nothing remains but to thank you for the kindness you have always shown me and to wish you a speedy ending of the present period of agricultural depression and a return to prosperity. Farewell.

Poultry Breeding at the University of British Columbia

By E. A. Lloyd and V. S. Asmundson.

Barred Plymouth Rocks*

The foundation stock in Barred Rocks also came from the Oregon Agricultural College. Practically all of the individuals in the imported pen were the progeny of birds that had been bred for long distance production. The hens were of fair type, good bright color and of medium size.

Pedigree breeding with this strain apparently had established a uniformly good average production. In two years additional pedigree breeding within this strain at the University of British Columbia, the size of egg has been too small on the average to conform to Canadian Government standards in grading. An outcross was decided upon, as a feasible method of quickly increasing the size of egg. Accordingly, an unrelated male from a 270 egg hen, that laid eggs weighing 26 ounces per dozen, was secured, and was mated with the best of the Oregon line. As an individual, this bird was large, stretchy, finely barred and typical of the breed.

The results from this cross, as tested in the first year have been very sa-

* The first part of this article dealing with Wyandottes and Leghorns, was published in the last issue.

tisfactory. Egg weights have been increased from 1.92 ounces average per egg to 2.17 ounces, an increase of .25 ounce per egg or 3 ounces per dozen. This increase in size is rather remarkable for one year's breeding, but it is not expected that it can be sustained without very careful continued selection and breeding. Selection for size of egg is being carried on to such an extent, that any female laying an egg below 2 ounces in weight is being thrown out of the flock, regardless of the number of eggs laid. At the same time, those hens that have given a large number of high producing daughters laying a standard egg, and that have shown 50 per cent hatchability or better are retained as long as possible.

Outcrossing and Winter Production.

Another improvement that apparently has been effected by this cross is in winter egg production. An average of 60 eggs before March 1st in the pullet year has been attained. Yearly production also runs uniformly high in the progeny of this cross, 62 daughters having produced an average of 210 eggs per bird. High scores in these sisters for last year ran 283, 277, 268, 268, 254, 251, 249, etc., with only three birds out of the 62 laying below the Dominion R. O. P. minimum of 150 eggs.

The body weights of the above 62 pullets at the end of the first laying year averaged 6.62 pounds, while the weights of the mother Oregon hens averaged 6.42 pounds, and their inbred daughters 6.08 lbs. At the present time these 62 hens will be well up to standard weight for Barred Rocks.*

Promising Family Lines.

The daughters of old Oregon 144 promise well, having laid 202, 188, 204 and 230 eggs or an average of 206, with hatchability running close to 60 per cent. The eggs from the 230 egg hen weigh 2 ounces each, while the other three birds laid eggs that weighed 23 1-2 ounces per dozen in the spring of their pullet year.

* Note: The weights of the inbred daughters are comparable to the weights of the 62 pullets, being taken at same time and age.

Oregon 143 gave A634 whose 12 daughters laid up to 268 eggs and an average of 197. This family does not promise as well as the above in breeding ability however, and may be discarded.

From partial records it appears that the pullets from Oregon 147 were better average producers than from the other Oregon hens with the exception of 144. Only one of these pullets, A683, has been tested out as a breeder. Last year her ten daughters laid an average of 218.6 eggs with a maximum of 283, and none below 150. Eggs in this family line weigh 2.18 ounces each with hatchability running relatively high. Very little broodiness was apparent in the first year.

Barred Rock Hen A 683 that laid 179 eggs in 9 months (record incomplete) Mother of 10 daughters averaging 218.6 aggs, none below 150.

Nine of these full sisters make a good breeding pen. They are being mated to a male from another high producing, non-broody line. It is hoped that broodiness will be low in the off-spring of this mating, and it is reasonable to expect that the high production should be continued, especially since vigour seems intense in both sides of the family.

Observations About Barred Rocks.

Considerable variation has been observed in the type, size and color of the Barred Rocks that have been bred for

egg production at the various Government institutions and by private breeders in Canada. No serious difficulty has been encountered in the breeding work so far conducted at the University of B. C. in ability to secure birds that are fairly typical of the breed. Selection for type, however is never ignored even in the face of high production. The barred markings that have made this variety so attractive in appearance, have not been neglected and very litle smokiness or splashy barring is apparent so far in the progeny. Ringlet barring as seen in the best exhibition specimens as called for by the standard is not common, although fair exhibition specimens can be found. It seems to require only a reasonable amount of selection for bright colour marking in the males along with pedigree, to maintain a fair brightness in the average female.

The most serious problem to overcome so far has appeared to be the tendency towards degeneration in size of egg and texture of shell as birds are bred and

Barred Rock Hen B. 679 that laid 283 eggs in her pullet year to Nov. 1st. Her eggs weigh 2 ounces each.

selected for egg production. The most radical elimination of all females regardless of egg number has had to be exercised, in order to combat this tendency.

Rhode Island Hen 130, averaged over 200 eggs in first two years. Her six daughters last year averaged 215 eggs, with low score of 194 and high one of 264 in 12 months.

At the same time selection for color and shape of egg is steadily maintained.

Single Comb Reds.

The S. C. Rhode Island Reds at the University of British Columbia came from the Massachusetts Agricultural College, from stock that had been pedigree bred for a number of generations by Dr. Goodale, the noted Biologist and Geneticist.

The male heading the Massachusetts pen was out of a hen that laid 296 eggs in 365 days, while the hens were of 180 to 200 egg capacity. Good average egg production had been fixed in these birds by their pedigree. They were of good size and of fair type, but variable and generally light in color markings.

Hen 130 laid 230 eggs in her first year and 175 in her second making a good two year average for a Red. She has proved to be a good breeder. Six of her daughters this last year averaged 215 eggs, laying from 194 to 264 eggs each. The eggs from these hens are of good size and texture with fair hatchability.

The trapnest records of the first generation of daughters from 130 were not complete, and as such do not appear to be very much above the average of the

flock, but their progeny have proved to be above the average as breeders.. . .

Observations About Reds.

The breeding of heavy producing Reds presents a difficult problem. The breed is outstanding for its vigor and for the size and hatchability of eggs, hatchability, running under University of B. C. tests, being higher than with either the Barred Rocks or White Wyandottes. The chicks are at the same time somewhat more vigorous. A good commercial average in egg production apparently can be developed and maintained. The question of the amount of attention that can be paid to the bright, pure, lustrous red that the standard calls for, is problematical. Many disappointments have been experienced so far in efforts made to either maintain or to improve standard red color.. It is most difficult to secure males from high producing hens that are line-bred for color and egg production at the same time. Outcrossing appears dangerous because it has led to great variation in color markings and even to standard disqualifications such as stubs on legs and feathers and down between toes.. The development of high-producing, line-bred Reds that will reproduce true to standard color offers a big field for Red breeders.

Notes.

1st. All records at University of B. C. to date have been produced without the use of artificial light.

2nd. Birds referred to in article have produced records under students' practice work under the S.C.R. New groups of students coming on each week or each alternate week have no doubt affected records somewhat unfavorably.

3rd. Incubation conditions have been far from ideal, so that fertility figures quoted are probably lower than they ought to be.

4th. All records have been produced under a nine hour day labor system, which has militated somewhat against obtaining the greatest efficiency.

Diseases of the Potato

By B. T. DICKSON,
Professor of Botany, Macdonald College.

(*Continued.*)

In the January number of *Scientific Agriculture*, two diseases were discussed—Powdery Scab and Black stem-rot. Before dealing with the next group several points are worthy of mention regarding the above diseases. Dr. Morse, Director of the Maine Station, has informed the writer in correspondence that Powdery Scab has not been found to any extent during the last five or six years in Maine. That a similar situation occurs in New Brunswick is borne out by correspondence between Dr. Morse, Mr. Cunningham and the writer.

The outline list of diseases to be dealt with during this series is given in Vol. II, No. 2 (Oct.), 1921 and under Group 7 "Skin spot" caused by *Oospora pustulans* is placed among the diseases caused by Fungi imperfecti. Potatoes with a spot apparently exactly like that caused by *O. pustulans*, as described in England, were found in shipments to the Spokane market from British Columbia. In fact Heald found that 95 per cent of the tubers showed lesions. The spots are circular, brown and small when young, darkening with age. At first the spots appear slightly elevated but later somewhat depressed.

Under moist conditions sporulation and growth occur in the lesions so that further necrosis occurs. Shapovalov, in a paper given at the Toronto meeting of the American Phytopathological Society, states that the pustules are identical with those of the immature or closed-sorus stage of powdery scab. This author investigated the fungi which, as secondary organisms, invade the "skin-spot" pustules and found that they varied with the locality.

With regard to control of the Black stem-rot of potatoes it was stated that the formaldehyde method should be practised. It should be pointed out that this method will not affect bacteria inside the tissues

but only those on surfaces cut or uncut. Nevertheless, it is a sound practice as a general rule with doubtful seed tubers. In this sense it was recommended.

Group 4.—Diseases caused by Phycomycetes.

The Phycomycetes are the alga-like fungi, as a rule possessing non-septate vegetative mycelium and developing both sexual and asexual spores. In some cases the mycelium is profuse and in others it is reduced to a minimum. Zoospores or motile spores are produced in the cases under consideration.

(a) Black Wart or Potato Canker.

This is one of the most serious and virulent of potato diseases and is now known to occur in England, Scotland, Ireland, Scandinavia, Germany, France. Italy and it has been reported from Africa. It is common in Newfoundland but is practically confined to Pennsylvania on the continent. In Pennsylvania the report by McCubbin showed that in 1920 the disease occurred in 781 gardens in 53 towns of 9 counties, so that the area involved covers approximately 3,000 acres although the actual areas total about 100 acres.

The disease is known under various descriptive names, such as Cauliflower disease, Black Scab, and Wart disease, but Potato Canker or Potato Wart are more commonly accepted. Schilberszky discovered the disease in Hungary in 1896 and attributed it to *Chrysophlyctis endobiotica.* Percival in 1910 made further studies and named the causal organism *Synchytrium endobioticum.* Its appearance on this side of the Atlantic was first announced by Gussow in 1919 from Newfoundland material.

Symptoms.

On above-ground parts there are rarely any symptoms but occasionally the fungus may gain entrance to the haulm, lower axillary buds or leaves. If this happens the infected tissue is stimulated to excessive growth giving rise to variously shaped excrescences. It is on the tubers that the symptoms are usually found and here the buds or eyes are affected. Diseased buds are stimulated to such hypertrophic growth that they may be no longer recognisable. If

Fig. 10 Potato Canker.
Susceptible variety (Cumberland Ideal) showing effect on tubers. Two cankers on above-ground parts can be seen.
(From Supplement 18 to Jour. Bd. Agric. Eng. 1919).

the eye is affected late in the season of its growth the nodular excrescences may be noticeable only on careful examination. But if the eyes are attacked while the tuber is quite young the excessive growth of the tissues will give rise to nodular irregular masses entirely unlike a tuber. (See Fig. 10). The demand for food on the part of the organism will be so great that any stored in the developing tuber will be used up and the tissues will collapse. In this necrotic condition lies the greatest danger. It is impossible to harvest such diseased tubers without leaving behind fragments, which are filled with sporangia, in the soil. The resting sporangia thus left behind may

remain viable for several years and constitute a source of infection if potatoes of a susceptible variety are planted. Cases are on record in which the disease has reappeared after an interval of ten years in England.

Life History of the Fungus.

The resting sporangia which average about 52 microns in diameter contain many round zoospores which measure 2½ microns in average diameter. In the spring the resting sporangia may germinate and the released zoospores are motile in the soil water for a time. Eventually they become amoeboid by the withdrawal of the single cilium and in this stage they enter the young tissues of stolon or buds. After the infected tissues have been depleted of food the fungus in each cell rounds up, develops a protective wall and becomes a summer resting sporangium. This may germinate, the resulting zoospores giving rise to secondary infections. Toward the close of the growing season winter resting sporangia are formed in a similar manner. Another type of summer sporangium is that in which thin-walled structures, sometimes in groups, are developed in a sorus. Each thin-walled sporangium contains numerous zoospores which are smaller than those from the ordinary type of resting sporangium.

Other Hosts.

To date the tomato is the only other host known to be susceptible in America. In England Solanum nigrum and S. dulcamara are slightly susceptible.

Varietal Susceptibility.

The work of Weiss and Orton shows that Green Mountain, Cobbler and Burbank are immune while Rural New Yorker. Early Ohio, Early Rose, Triumph, Pearl and Up-to-Date types are susceptible.

Control.

This disease does not, so far as is known, occur in Canada and samples of any doubtful tubers should be sent immediately to a reputable authority for determination. Where the disease does occur the only control is the planting of immune varieties.

(b) Leak of Potatoes.

With the development of distant markets storage and transit diseases are of increasing economic importance. "Leak" is one of the most serious of these diseases. It has been ascertained by Link that "Leak" is practically co-extensive with the potato crop of the United States. So far as the writer knows it has not been reported from Canadian markets.

Symptoms.

The disease is first apparent as a small brown discoloration around a wound such as might be caused during digging. The casual organism lives in soil and can enter the tuber only through wounds exposing the inner tissues. The fungus grows through the tissues causing the tuber to become brown over the entire surface. In this condition it is soft, easily crushed and pressure causes the exudation of a brownish watery liquid. In advanced stages the symptoms might frequently be mistaken for those of tuber rots caused by Fusarium species.

Life History of the Fungus.

Orton has shown that a similar rot may be produced by *Rhizopus nigricans* Ehrenb. but the work of Link demonstrates that "Leak" is usually caused by *Pythium debaryanum* Hesse.

This fungus is aggressively parasitic if humidity and temperature conditions are satisfactory and is the common cause of "damping off" in greenhouses and nurseries. The mycelium is coenocytic, except with age, irregularly branched and rather coarse. Conidia are produced terminally on branches of the mycelium or they may be intercalary. They are globose to elliptic and average 22 microns in diameter. They may germinate at once by one or more germ tubes. Oospores are also produced which are smooth, spherical and thick-walled and able to live over an adverse period. Growth is slow at 48 deg. F. and practically ceases at 41 deg. F. while it is best at about 86 deg. F. In an ex-

perimental inoculation Link found that at 86 deg. F. the fungus penetrated to a depth of 4 cm. ($1\frac{1}{2}$ ins.) in 67 hours.

Varietal Susceptibility.

Rurals and Burbanks dug during warm weather are especially susceptible and inoculation experiments by Link tend to show that Triumph, Green Mountain, Early Ohio, Rural New Yorker and Irish Cobbler are susceptible.

Control.

The disease can be controlled by care in harvesting and handling potatoes and by sorting out wounded tubers.

(c) Late Blight and Rot.

This disease, caused by *Phytophthora infestans* (Mont.) De Bary, is too well known to need emphasizing as to its economic importance. It is not often that a fungus can materially affect the policy of a country but this is what *Phytophthora infestans* did in Great Britain. Late blight was so serious in 1845 in England and Ireland that the potato crop was a failure. So much was this the case in Ireland that a famine occurred and many thousands of Irishmen left Ireland for America. To relieve the distress the Corn Laws were repealed and in a sense this initiated a Free Trade policy.

The disease is now controllable so that epiphytotics are rare; nevertheless a warm, wet summer is a season of worry to the potato grower in the Maritime Provinces, Quebec, New England States and New York. It is common in Europe from east to west where the growing season is moist and mild.

Symptoms.

Irregular spots at the margins or tips of leaves are produced which are at first water-soaked. The position of the lesions is due to the drainage of the water on the leaf surface in which the spores germinate. If the weather becomes dry the lesions turn brownish and dry out more or less. Under humid conditions the mycelium in the leaf tissues grows rapidly and sends out through stomata in the lower surface branches which abstrict conidia in profusion. The conidiophores are usually so numerous under these conditions that a distinct pale violet tinge is given to the affected lower surface. If the disease is not checked the leaves are rapidly destroyed and gradually the stems are affected.

On the tubers the first symptom is a slight darkening of the skin over an infected area. Later this area becomes slightly sunken and a dull reddish-brown in color. Gradually the mycelium of the fungus penetrates the tissues causing a dry-rot if no secondary organisms are present.

A general symptom in a seriously affected area is the odor, which is difficult to describe but is something like stale herring-brine.

Life History of the Fungus.

Most Phycomycetes live over adverse seasons as a sexual structure known as an oospore. It was therefore natural to look for oospores in *Phytophthora infestans* but not until 1875 was any statement made that oospores had been found. De Bary had studied the disease previously and concluded that the fungus lived over in the tuber. In 1875 Worthington G. Smith announced that he had found oospores of the fungus. De Bary again studied the case and again concluded that mycelium lived over in the tuber. Since then, L. R. Jones (1909), Clinton (1911) and Pethybridge and Murphy (1913) have found oospores in pure cultures of the fungus. The work of Melhus (1915) shows that mycelium living-over in the tuber can initiate an outbreak of the disease and that oospores have not yet been shown to give rise to the first outbreak.

Regarding, therefore, mycelium in the tuber as the over-wintering stage infection of a shoot just beginning to grow can take place by the growth of mycelium from a nearby lesion in the tuber. If the shoot is attacked early in its growth dwarfing will result so that when normal shoots are 8 inches tall the infected shoots may be only just above ground. Sheltered by the foliage of healthy stems and given satisfactory temperature and moisture conditions conidiophores will grow out through stomata in the dwarfed shoot and conidia will be abstricted. Not many are needed to initiate the outbreak. A conidium germinates in a short time in a thin layer of water on the leaf giving rise to 8 zoospores. These are motile for perhaps an hour, then they come to rest, germinate by a germ tube and infect the leaf. Under moist summer conditions this is repeated approximately in 10 days, but the period elapsing between successive sporulations increases with decreasing humidity.

Tuber Infection.

Some spores are washed through interstices of the soil to the tubers in the upper part of the hill, and if the skin of the potato is still immature infection may easily occur. Early infection may cause total rotting of the tuber, while later infection may only give rise to small lesions. It is most important to remember that late attacks of blight will mean a plentiful supply of conidia on surface soil and plant parts at digging time and most tuber infection occurs at this stage.

Control Measures.

1. Selection of sound seed tubers.
2. Thorough spraying with Bordeaux from July to mid-September.
3. Hilling of potatoes to protect upper potatoes in hills from tuber infection.
4. Removal of tops two weeks before harvesting to prevent tuber infection.

CORRECTING AN ERROR

In our last issue, on page 167, reference was made to the results obtained by the O.A.C. judging team at the recent international Live Stock Exposition in Chicago. After stating that F. W. Walsh obtained the highest individual score in the whole competition, the latter part of the second paragraph should have read as follows:

"The other four members of the team came 5th, 15th, 52nd and 59th in the whole competition."

At this opportunity it may also be stated that the O.A.C. team had the high man in beef cattle and hogs, 2nd man in beef cattle, 7th and 8th in hogs and 10th man in sheep. The team came second in horses, hogs and sheep and eighth in beef cattle. The members of the team were F. W. Walsh, R. E. White, G. E. Raithby, D. H. Hart and F. J. Greaney.

Agriculture Generale

Note de la Rédaction.—Pour des raisons incontrôlables, le rédacteur de la section française de la Revue Agronomique n'a pu nous faire tenir la matière que nous attendions pour ce numéro.

Pour remédier à cet imprévu, nous avons extrait du Bulletin Mensuel des Renseignements Agricoles, les notes suivantes qui intéresseront sans doute nos lecteurs.

F. H. G.

L'approvisionnement des engrais chimiques et l'augmentation de la production agricole en Allemagne.—Hiltner (Direktor der Bayer, Landesanstalt für Pflanzenbau und Pflanzenschutz).

L'A. expose les conditions de la production agricole au point de vue des approvisionnements des engrais chimiques pour l'Allemagne et, en particulier, pour la Bavière.

La baisse du prix des produits alimentaires, si désirée, ne pourra avoir lieu que lorsque la production agricole aura non seulement atteint le niveau qu'elle occupait avant la guerre, mais l'aura même dépassé. Par contre, malgré tous les appels à l'augmentation de production, celle-ci décroît désormais d'une année à l'autre, surtout pour les céréales et les pommes de terre, de sorte que, si l'on n'arrive pas à y porter remède, ce sera une catastrophe pour le peuple allemand.

Les causes de cette situation, qui produira, dans les années à venir, de grandes difficultés annonaires, résident dans des obstacles de différente nature qui entravent la production agricole: insuffisance de main-d'oeuvre, diminution exceptionnelle du fumier tant en quantité qu'en qualité, manque ou application défectueuse d'engrais chimiques. Ces inconvénients poussent de plus en plus les agriculteurs vers une culture extensive, alors qu'une alimentation à peine suffisante du peuple allemand avec des produits indigènes exigerait une culture des plus intensives.

Durant ces 6 dernières années, le terrain cultivé de l'Allemagne a reçu 1,500,000 tonnes d'azote et 1,600,000 tonnes d'anhydride phosphorique de moins que le néces-

saire, de sorte que, dans la meilleure hypothèse, ce déficit ne pourra être compensé que peu à peu (1). Pour satisfaire ce besoin extrême d'azote de la plupart des terrains, tout l'Empire allemand disposait au minimum, pour la campagne 1920-1921, de 270,000 tonnes d'azote sous forme d'engrais chimiques, tandis que la capacité de production d'engrais azotés synthétiques par les établissements créés pendant la guerre serait de 500,000 tonnes, ce qui constituerait le besoin annuel minimum pour l'agriculture allemande.

Le besoin d'anhydride phosphorique est aussi particulièrement important, parce que la production de scories Thomas a diminué à cause de la perte des bassins sidérurgiques de l'ouest, et parce que les superphosphates doivent être presque exclusivement préparés avec les phosphates d'outremer, dont les changes rendent les prix très élevés; c'est pourquoi les scories Thomas coûtent 20 fois plus qu'avant la guerre et les superphosphates 33 fois plus (étant donné le prix encore élevé des pyrites, qu'il faut importer). La consommation totale d'anhydride phosphorique des engrais chimiques, qui avait été en Allemagne, pour la campagne 1913-1914, de 630,000 tonnes, était descendue, en 1918-1919, à 230,000 tonnes, et elle a encore diminué ultérieurement. Comme la consommation des engrais avait été antérieurement minime en Bavière, on ne peut pas y compter, en général, sur des réserves de phosphate accumulées dans le terrain par de fortes applications précédentes (2); en effet, il résulte d'un examen des terrains bavarois, effectué en 1920, que plus d'une moitié des terrains expérimentés présentaient une insuffisance d'anhydride phosphorique.

De toute façon, si le Gouvernement n'apporte pas son concours pour provoquer la diminution des prix tant des engrais azotés que des engrais phosphatés, il convient de chercher une autre voie pour arriver à cette diminution ou, au moins, d'en renvoyer le paiement de 2-3 à une échéance à établir après la récolte.

Quant à la consommation de sels potassiques, elle s'est, par contre, notablement accrue ces derniers temps en Allemagne; le prix n'en ayant été augmenté que de 5 ou 6 fois, il suffit qu'ils ne subissent pas une nouvelle hausse; on peut obtenir ce résultat en en exportant une quantité importante, ce qui en augmentera nécessairement la production, en tenant compte aussi de la perte des gisements alsaciens. La première condition pour obtenir de bons effets des sels potassiques et des engrais azotés, c'est une réserve suffisante de chaux dans le terrain; or, en Bavière, de nombreux ter-

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(1) D'après Muller Lenhartz (*Der Kreislau) des Stickstofles*, p. 29-32, Hanovre, 1917), la quantité moyenne d'azote exportée de 1 ha de terrain cultivé par les 30 cultures principales serait de 90 kg par an, qui, multipliés par les 34,500,000 ha cultivés en Allemagne avant la guerre, donnaient, pour l'Empire allemand tout entier, une consommation d'azote de 30,050,000 quintaux; les apports suivants y faisaient face en partie:

	Quintaux
Semences	862,500
Précipitation atmosphérique . .	414,000
Bactéries des légumineuses. . . .	9,500,000
Purin	1,275,000
Urine humaine	760,500
Excréments solides	1,000,000
Déchets industriels.	1,000,000
Produits secondaires du gaz. .	713,000
Cyanamide de calcium.	150,000
Ammoniaque synthétique	63,636
Nitrate de soude importé	100,000
Total	15,838,636

Il y aurait donc un déficit de 14,305,364 quintaux d'azote qu'on ne voit pas comment couvrir, à moins qu'il n'y ait, dans le sol, d'autres énergies microbiologiques, qui tirent la différence de l'air (*N. de R.*)

(2) D'après Acreboe (Volksernahrung, Stickstoffdünger und Stickstoffpreise, II. *Kreislaü des Stickstofles*, p. 29-32, Hano-688-689, 18 déc. 1920), les conditions générales de l'Allemagne, en ce qui concerne la fumure phosphatée, seraient meilleures qu'il ne semble; se fondant sur les données de Gerlach, d'après lesquelles, si les récoltes exportaient en moyenne du terrain seulement 1 partie d'azote, ½ d'anhydride phosphorique et ½ de potasse, le terrain recevait en compensation 1 partie d'azote, 3 d'anhydride phosphorique et 2.7 de potasse, et comme, pratiquement, l'anhydride phosphorique n'est pas délavé, une bonne réserve devrait en être restée dans le terrain allemand. (*N. de R.*)

rains cultivés et en prairies, comme on l'a constaté nombre de fois ces dernières années, sont très pauvres en chaux; il faut remédier avant tout à cette insuffisance au moyen de chaulages et de marnages étendus.

Il faut également ne pas perdre de vue qu'un rabais sur les prix des engrais azotés et phosphatés ne suffit pas, surtout dans les pays où, comme en Bavière, c'est la petite propriété qui domine; il y faut absolument une organisation qui vienne techniquement en aide à chaque agriculteur.

Production de semences pour le commerce selon la méthode améliorée suédoise, et progrès déjà réalisés au Canada et dans la Nouvelle-Galle du Sud.—I. Breakwell E., The Production of Better Seed in Other Countries, dans *The Agricultural Gazette of New South Wales;* II. Newman, L. H. (Secretary Canadian Seed Grower's Association), Seed Centres in Canada, dans *The Agricultural Gazette of Canada.* III Cutler G. H., The Beginning of an Important Movement for Supplying Pure Seed. *Ibidem,* p. 154, Ottawa, mars-avril 1921.

L'amélioration des plantes cultivées et de la production de leurs semences pour le commerce a été pendant un certain temps sérieusement entreprise dans les pays européens, ainsi que dans l'Amérique du Nord. Les deux pays qui tiennent la première place dans ce domaine sont, selon l'A., la Suède et le Canada. Les méthodes adoptées en Suède ont servi de modèle aux autres pays et l'A. les décrit.

I.—Suède. La "Compagnie générale suédoise pour la production des semences, organisation commerciale privée pour la production, le traitement et la vente de semences agricoles en gros, achète toutes les semences améliorées produites par l'Institut de Svalof et s'occupe de leur production ultérieure pour le commerce. Cette production a lieu soit dans les terres de la propriété de la Compagnie, soit par contrat avec des cultivateurs particuliers. Les conditions des contrats peuvent être résumées comme suit:

1) Le cultivateur entreprend la production de semences pour le compte de la "Compagnie Générale suédoise pour la production des semences."

2) Il a le devoir de remettre à la Compagnie, sans rémunération, une quantité en poids de semences égale à la quantité reçue, plus 25 pour cent.

3) Ou bien le cultivateur doit livrer toutes les semences produites par lui contre une prime établie.

4) Si la Compagnie ne peut pas accepter l'échantillon de qualité moyenne que le cultivateur a l'obligation de remettre, tout engagement de sa part cesse à l'égard du cultivateur.

5) Le cultivateur doit livrer les semences mondées.

6) Il s'engage à permettre qu'un représentant de la Compagnie inspecte en tout temps la récolte, aux frais la Compagnie.

7) Si la récolte n'est pas approuvée comme propre à fournir des semences pour la Compagnie, pour cause de récolte mal faite, de mauvaise odeur, de faible faculté germinative, de mélange avec des qualités étrangères, de maladies ou d'autres causes, et si, de toute façon, ces circonstances résultent de la négligence, d'opérations manquées de la part du cultivateur, ce dernier sera obligés, s'il en est requis, de payer les semences qui lui ont été remises au prix coté pour lesdites semences dans le catalogue de l'année.

8) Si la marchandise remise ne correspond pas à l'échantillon, ou si, à la suite d'un examen plus approfondi, l'on constate qu'elle n'est pas de la qualité voulue, ou si, pour une cause quelconque, la marchandise n'est pas propre à l'ensemencement, elle sera estimée de commun accord entre la Compagnie et le cultivateur.

I.-II. Canada (1). — Il semble pratiquement certain que cette méthode a servi de modèle au Canada. Une "Canadian Seed Growers' Association" (Association canadienne des producteurs de semences) a été fondée en 1900. La Société engage des agents provinciaux ("provincial officers") pour l'inspection des champs, et a ses propres agents pour l'inspection finale de la marchandise mise en sacs. La méthode adoptée est la suivante:

1) Peut faire partie de l'association tout agriculteur digne de confiance et qui s'est montré capable de produire des semences sélectionnées;

2) L'agriculteur qui entreprend la production de semences pures reçoit de l'As-

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(1) Voir *B.* mars 1921, No. 280. (*N. de R.*)

sociation la partie initiale. C'est la "semence enregistrée de première génération" (d'une famille sélectionnée), ou "semence d'élite" (c'est-à-dire semence pure, dérivant d'une plante unique ou bien obtenue d'une parcelle de graines choisies à la main);

3) Toutes les semences et les récoltes de quelque espèce que ce soit, produites ou sélectionnées par un sociétaire pendant les années suivantes, ont droit à l'enregistrement de la part de l'association;

4) Il est délivré des certificats; *a*) pour les semences produites selon les règlements ou obtenues au moyen de "semences d'élite; elles sont désignées comme "semences enregistrées"; *b*) pour les semences d'élite pures;

5) On n'accorde pas de certificats si les semences ne sont pas: *a*) de variété pure et conforme au type; *b*) exemptes de mélange avec des graines d'autres plantes cultivées; *c*) exemptes des graines de mauvaises herbes appartenant à la catégorie des "noxious weeds" (mauvaises herbes du "Seed Control Act". [Loi pour le contrôle des semences]); d) exemptes de graines d'autres herbes de moindre importance, ou n'en contenant qu'une au maximum; *e*) bien mûres, propres, saines, pleines, de belles dimensions, de belle couleur, exemptes de maladies; *f*) avec le pourcentage de vitalité requis pour les bonnes semences de cette espèce par le "Seed Control Act."

II.—Les méthodes susindiquées ont obtenu un grand succès et sont volontiers adoptées par les cultivateurs; actuellement la demande de "semences enregistrées" surpasse la production. Par exemple, la "Canadian Seed Growers' Association" essaie de recueillir dans l'Ontario un certain nombre de vagons de semences enregistrées d'avoine "Banner", mais l'approvisionnement n'est pas en mesure de satisfaire aux demandes du commerce.

L'A. est d'avis qu'il faudrait établir au moins un bon centre pour la production des semences dans chacun des districts où peuvent être produites, avec une grande perfection et en quantités considérables, les semences de qualité supérieure de l'espèce la plus demandée.

Le prof. Cutler informe que, pendant ces 3 dernières années, le "Department of Field Husbandry" (Faculté d'agronomie) de l'Université de l'Alberta a consacré une grande activité à la formation d'un type uniforme, à la purification des vieilles variétés de plantes cultivées de toute espèce et à la création de nouvelles sortes. Pendant cette période, il y a eu une demande considérable et continue de semences pures de bonnes variétés, ainsi que d'informations sur la façon de se procurer des "semences enregistrées."

En réponse à ces requêtes, on a envoyé, dans presque tous les cas, des échantillons de quelques onces (1once — 28 g) pour l'essai ou 1 hl ou plus pour la multiplication. Pendant les deux dernières années agricoles, on a confié 1500 autres échantillons de semences aux producteurs intéressés qui ont entrepris l'essai et la multiplication des races améliorées et purifiées de plantes agricoles. C'est le commencement d'un mouvement important pour la production des semences dans l'Alberta, mais cela demande une organisation spéciale.

Pour satisfaire, dans une mesure appropriée, la demande de semences de la part des agriculteurs, l'Université d'Edmonton est disposée à coordonner tous les travaux en coopération pour l'essai, la distribution et la multiplication des semences, au moyen d'une Association qui aura le nom de "Alberta Crop Improvement Association" (Association de l'Alberta pour l'amélioration des plantes cultivées).

I.—Nouvelle-Galles du Sud. — Le Département de l'Agriculture a déjà commencé ses travaux pour l'amélioration des semences. Les méthodes adoptées diffèrent des méthodes adoptées par le Canada et la Suède par le fait que le Département traite directement avec les agriculteurs. *L'agricultural Gazette* de la Nouvelle-Galle du Sud publie tous les mois une liste des producteurs de semences pures et de bonne qualité de froment, d'avoine, de maïs, de sorgho, de "Sudan grass" (*Sorghum exiguum*), de pommes de terre, etc., de façon à mettre les agriculteurs en rapports directs avec les producteurs dignes de confiance.

La liste est établie après inspection des semences et sur la base du rapport d'un inspecteur qui doit visiter les champs, de préférence pendant la période de végétation; les cultivateurs qui ont des semences pures de qualité supérieure, de n'importe quelle espèce de plantes agricoles, sont invités à le communiquer au Département de l'Agriculture à Sydney.

Expérience faites aux Etats-Unis concernant l'effet sur les vaches de l'acide cyanhydrique contenu dans le "Sudan Grass". — Swanson, C. O., dans **Journal** of the American Society of Agronomy, vol. XIII, No. 1, p. 33-36. Washington, janvier 9121.

Des cas occasionnels d'empoisonnement de vaches causés par la consommation du "Sudan Grass" (*Sorghum exiguum*) ayant été signalés, le "Dairy Department" du "Kansas State Agricultural College" a effectué, en 1919, des expériences avec 6 vaches Holstein mises en pâturage de juillet à octobre sur une parcelle de "Sudan Grass' d'une superficie de 2ha, 19. Dans un certain nombre d'échantillons de "Sudan Grass", on détermina la teneur en acide cyanhydrique. En octobre, 2 autres vaches n'ayant encore jamais consommé de "Sudan Grass" furent mises dans le même pâturage. Voici les brefs résultats de ces expériences préliminaires:

On put constater que, malgré le taux élevé d'acide cyanhydrique dans le "Sudan Grass" consommé comme pâture, il n'en résulta aucun effet nocif pour les vaches.

Au cours des analyses, on constata que la mise en liberté de l'acide cyanhydrique est associée à une action enzymatique. En faisant digérer l'herbe dans de l'eau, à la température de la chambre, pendant quelques heures, puis en distillant, on obtint dans le distillat un taux d'emblée ajoutant de l'acide sulfurique. L'eau plus élevé d'acide cyanhydrique qu'en y chaude et la chaleur sèche diminuèrent le taux d'acide cyanhydrique obtenu, tandis que le séchage lent provoqua sa disparition. Le dosage d'HCN dans des échantillons fanés ou recueillis plusieurs jours d'avance peut être considéré comme sans valeur. Des epreuves effectuées sans retard sur de l'herbe gelée ont mis en évidence un taux très élevé d'acide cyanhydrique, qui disparaît rapidement ausitôt que la plante commence à se faner et qui a complètement disparu lorsque la plante est sèche.

Enfin, dans le cas des deux vaches n'ayant encore jamais consommé de "Sudan Grass" et sur lesquelles le pâturage n'avait exercé aucun effet nuisible, il déroule de l'expérience qu'il ne peut s'agir d'une immunité acquise par l'habitude de la consommation de "Sudan Grass".

Les résultat ne permettant encore aucune déduction définitive, de nouvelles expériences plus étendues sont projetées.

Effet du chaulage sur l'assimilabilité de la potasse, du phosphore et du soufre du terrain.—Plummer J. K. (North Carolina Agricultural Experiment Station, West Raleigh, N. C.), dans *Journal of the American Society of Agronomy*, v. XIII, No 4, p. 162-171, bibliographie de 21 publications. Lancaster, Pa., avdil 1921.

Discussion au sujet de la question importante des effets du chaulage sur l'assimilabilité de la potasse, des phosphates et du soufre du terrain.

Les recherches les plus récentes, comprenant soit des travaux de laboratoire (extractions au moyen de dissolvants faibles; cultures en pot en employant une variété de plantes comme indicateurs de la concentration de la solution du terrain en potasse et en faisant l'analyse de leurs cendres; expériences avec le lysimètre pour la détermination des pertes de potasse), soit des expériences en plein champ, n'ont pu démontrer que les composés basiques de calcium et de magnésium augmentent sensiblement, par action chimique, l'assimilabilité de la réserve de potasse naturellement présente dans le terrain.

Institution d'un Laboratoire de recherches scientifiques en Galice, Espagne.—La "Junta por Ampliacion de de Estudios" (Commission pour le développement des études) a institué, en Galicie, un Laboratoire de recherches scientifiques destiné à des études concernant l'agriculture, l'arboriculture, la zootechnie, la pisciculture, etc. Le siège de cet Institut se trouve dans les bâtiments occupés par l'Ecole vétérinaire de Santiago.

La même Commission a confié à M. Cruz Gallastegui, qui a étudié aux Etats-Unis les méthodes qu'on y a adoptes, l'exécution de travaux de sélection du maïs.

L'organisation de l'instruction technique n'est pas une simple question pédagogique; c'est, au premier chef, une question vitale pour notre pays.

: : EDITORIAL : :

For the last four years the Civil Service Commission and re-classification have been bywords in Ottawa, and the grievances of employees in the Dominion Department of Agriculture have surely been thoroughly aired by this time. There was a period, about 1918, when individual appeals and group appeals were almost a weekly occurrence. Some members of the Department were particularly gifted in the matter of drafting appeals and in giving evidence before the Appeal Board. In those days the position of Deputy Minister was a most unenviable one and his office hours must have been long and often almost unbearable. He was expected, as a matter of course, to use his influence, especially in the case of technically trained men, and if action was delayed or, when taken, was open to criticism, the blow more often fell upon the Deputy Minister than upon anyone else. And it was, of course, always the matter of salary which caused the difference of opinion. Appeals were always revisions of salaries. A comparison of the wages of street car conductors with the salaries of technically trained agriculturists probably appeared in every appeal.

There is no doubt that the Civil Service Commission was inexcusably out of joint in some of its so-called classifications of trained men. Odious comparisons could be found, by the dozen, in their published scale of salaries. A plant pathologist with a University degree and post graduate training did not command as high a salary as the superintendent of char service with primary school education. Some of the technical men in the Department facetiously figured out that an "un-educating course" should be introduced so that they would better qualify for higher salaries.

The Civil Service Commission was unusually firm. It listened — slightly — to some appeals, and in some cases it modified — slightly — its previous decisions. But in nine cases out of ten (approximately) the technically trained man in the Department of Agriculture was given a low salary rating — low when compared with the salaries paid to trained men in other branches of the Service, and low when the cost, in money and in time, of his academic training was considered. The Civil Service Commission in its desire to be always consistent did not look very far ahead. It made no provision for keeping a good man in the Department when outside financial influences attracted him. Civil servants receiving salaries higher than their classified positions called for were not interfered with, but they must be replaced when they retired or died, by men attracted by the lower salary.

What has been the result of all this re-classification? If a full enquiry were made, in every branch of the Department at Ottawa, and if a list were compiled of the trained men who had left the service as a direct result of this same re-classification, it would not reflect special credit upon the Civil Service Commission. Such a report might go further and give a comparison of the professional training and experience of the men who left and the men who took their places (if anyone had been appointed). It is certain that the efficiency of the Department of Agriculture has not been improved by re-classification. Perhaps it is being operated more economically — we doubt it — but efficiency and economy can surely be joined together in some way. This country needs such men, for instance, as Dr. Charles Saunders. We cannot have them because the salary listing of their positions is too low. Is there no way under this new system (?) of keeping men whose value to the profession and to the country cannot be estimated in mere dollars and cents?

What will be the future result of this method of grading salaries in accordance with certain stipulated qualifications and assigned duties? It will mean that vacancies in the Civil Service — and there will probably be many of them — will be filled by incompetent applicants, because the salaries offered will not attract trained and qualified workers. If re-classification

is necessary, and the qualifications required of every employee must be set down in black and white, then the salary rating should, in the public interest, be in exact ratio to the importance of the position and to the duties to be performed. Further than that, special provision should be made in some way so that a man or woman of exceptional merit can be retained in the Service on the representation of the Deputy Minister. It would seem only logical, too, that the Deputy Minister should be fully consulted in all cases of appointment since he is more familiar with the type of work to be performed than are the members of the Civil Service Commission. Surely in the administration of the public service there is room for logic and co-operation and common sense.

With the present issue *Scientific Agriculture* takes another step forward. The size of the magazine has been increased by eight pages, and this improvement has been possible in spite of continued depression in the publishing business. When most agricultural magazines are appearing less frequently or in a modified form, it is very gratifying to make progress in the opposite direction. It speaks well for the organized body of professional men who are behind the publication.

Up to the present time we have never been able to publish long articles because of the amount of space they occupied. When a long article was submitted, it was usually split into two parts and published in two consecutive issues. That was a disadvantage and detracted from the reading value. In the present issue we have published our first long article in complete form. The article on "The Spoiling of Milk" by Professor Sadler and Miss Mounce contains approximately ten thousand words but we have been able to print it in one issue and still publish a number of other interesting papers. We hope that our progress in this respect will be continuous and that further improvements can be made from time to time.

In this connection, it is perhaps timely to again remind our readers that frank criticisms and suggestions are always welcome.

It is interesting to note that a magazine such as "The Chemical Age", which normally is devoted to industrial and engineering chemistry, and in which the agricultural industry plays a comparatively small part, has given, in its issue of January 28th, considerable prominence to our industry. There is editorial reference to the relation of chemistry to agriculture and several articles are published dealing with artificial fertilizers "from the point of view mainly of supplies and manufacture."

That agriculture and science are closely bound together is receiving more frequent demonstration in recent years than ever before.

An inquiry as to Government aid to carbonate of calcium production in the interests of agriculture is the purpose of a trip to Europe being undertaken by Mr. J. Emile Vanier, civil engineer, secretary-treasurer of the Montreal Crushed Stone Company, Limited and president of the Province of Quebec Association of Architects.

Mr. Vanier will visit the most important industries producing carbonate of calcium in England, France and Belgium. He will also, if time permits, go into Germany where these industries receive from the German Government special consideration, so that the material they are producing for agricultural purposes can be delivered to farmers in the most economical way and at the lowest cost, a factor to which is attributed much of the credit for the remarkable results secured by Germany in agriculture.

Mr. Vanier will seek to learn what advantages foreign Governments are giving to the industries similar to his, in the form of bonuses or subsidies to companies, or to associations formed by farmers or individuals to promote the general interest of agriculture by encouraging the use of limestone on the lands, and what methods are taken to assure economical and convenient distribution such as the provision of warehouses or bins for the storage of ground limestone at railway stations, where it would be handy for the farmers and the public in general. The result of Mr. Vanier's observations will be embodied in a report to be laid before the agricultural bodies of the province, with a view to making representations to the Government regarding the desirability of encouraging the use of crushed limestone on the land.

(Montreal Gazette.)

The Spoiling of Milk

By Wilfrid Sadler, M.Sc. and Marion J. Mounce, B.A., B.S.A.

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The spoiling of milk is primarily due to the activities of bacteria. Other factors, agencies and conditions associated with this spoilage are either contributory to the bacterial activities or are of secondary importance. The researches of Moore & Ward, (1) Harrison, (2) Savage, (3) Harrison & Savage, (4) Bergey, (5) Conn Esten & Stocking, (6) Harding & Wilson, (7) Evans, (8) and others on the bacterial content of the normal udder of healthy cows, have shown that milk as secreted may be sterile; but that in the udder itself a limited flora persists. The numbers and types of bacteria found in the milk drawn at the beginning of and during the early stages of milking, are variable, even when aseptic precautions are taken; for there is the possibility of external contamination of the udder via the teat canal. In the strippings, or milk drawn during the later stages of the operation, the bacterial content is low, the flora is more constant, and the types are well defined. Certain strains of the bacteria which have been isolated from the udder have a specific action in milk; but the causative organisms of milk fermentations in a major sense are chiefly those which obtain an entrance during and subsequent to the operations of milking. It would appear therefore, that, in the main, the bacterial contamination of milk is preventable; and it would necessarily follow that the spoiling of milk is preventable just in so far as we are successful in preventing and controlling the entrance and multiplication of bacteria. The extent to which preventable measures are possible in actual practice is a question of fundamental importance to the dairy farmer, to public health authorities, and to the community at large; for the rapidity with which milk spoils, decides the limit of its 'period of usability.'

In the work done on the milk supply of the City of Montreal by Harrison, Savage and Sadler (9) some 1500 examinations were made. Taking one phase of the investigation, it was found that out of 900 samples, 600 samples represented milk which could not have been sold in New York, Boston or Chicago, on account of the high bacterial content. In other words, had the law in Montreal been the law in existence in the cities mentioned, the milk represented by 600 of the 900 samples examined would have been lost to the community; that is, the 'period of usability' of the milk was so limited that it would not have provided for the time expiring between production and marketing. There is reason for believing that to-day the conditions pertaining to the milk supply of Montreal have been improved to a marked degree.

During the war, the Institute for Dairying Research, University College, Reading, was requested by the Imperial Government to enquire as to the losses in milk due to spoilage. The milk supply from two districts producing 90,000,000 gallons and 75,000,000 gallons per annum respectively was investigated. It was found by Stenhouse Williams (10) that at the time the milk should have been available for use by the consumer, no less than one per cent, or 1,650,000 gallons had spoiled. At prices current at that time, the financial loss is to be computed at $7,000,000. Not only was there the loss of money, but the loss in terms of food, and as concerns the infant and the child, the loss of a food for which there is no substitute. More recent researches undertaken by Freear, Buckley and Williams, (11) of the same Institute, have demonstrated the inter-relationship of conditions on the farm, age of milk and temperature at which the milk had been kept prior to its arrival in the laboratory, total bacterial content, and percentage of samples containing organisms of the *colon-aerogenes* group in 1 cc. of the milk at the time of examination. Further, the periods occupied by the milk in forming the clot when held at specific temperatures in the laboratory have been correlated with the aforementioned. When produced under satisfactory conditions, 71 of the 73 samples of milk examined contained 10,000 bacteria or less per cc; and 8 of the samples were found to have organisms of the *colon-aerogenes* group in 1 cc. In the milk

produced under more ordinary conditions, 18 of 69 samples contained over 200,000 bacteria per cc., and 49 of the 69 samples showed the presence of organisms of the *colon-aerogenes* group in 1 cc.

As a result of his researches into the bacterial quality of the milk of the City of Manchester, Délépine (12) concluded that "good milk should not clot after being incubated at 30 deg. C. for over 20 hours." He has devised a very ingenious adaptation of the "Fermentation Test" as a means whereby a moderately rapid test for the bacterial quality of milk may be conducted.

Milk "Clotting" Investigation.

In view of the importance of the question of milk spoilage, and in order that we might secure data with respect to the milk produced in the Province of British Columbia, we commenced an investigation some two years ago into the possible 'period of usability' of milk; and these researches are being pursued at the present time. In consideration of the necessity for milk in the diet, and particularly in the diet of the child, and having in mind the financial aspect of the case, it would seem to be a matter of considerable import that such measures shall be adopted and put into operation as will ensure that all milk shall enjoy its 'maximum period of usability.' For every hour that this 'period of usability' is lessened or limited, the farmer and the community suffer an economic loss. In our work we have used to some extent the classic laboratory methods for the determination of the bacterial content of milk; but our principal activity has been the conducting of 'clotting' experiments by the adopting of the "Fermentation Test". The observations which it is possible to record on the basis of these tests involving 'mass action,' constitute a distinct commendation of the method. And, we feel justified in hoping that eventually it will be possible not only to secure specific data on the 'period of usability' of milk, but that arising therefrom, we may accumulate evidence with respect to the associative action of bacteria as predicated by Marshall, (13) and also be in a position to discuss the specificity of mass fermentations. (Barthel), (14) (Gorini), (15.) Our procedure is as follows:—Samples of the milk to be tested are taken in sterile test tubes, incubated, and the mass reactions recorded. As will be seen from the data given herein, the incubators used are regulated to a temperature of 37½ deg. C. It is highly desirable that the work upon which we are engaged shall be carried on both at 37½ deg C. and at a standard 'room temperature.' Incubators suitable for the latter temperature are expensive, and it is only recently that we have felt justified in securing such.

For the present we can discuss the researches pursued at four centres, A. B. C. and D. In each centre, incubators (37½ deg. C.) have been installed during the period covered by the respective investigations. In some centres we have taken samples of mixed milk, and also of the milk of individual cows. The data presented immediately below, is concerned solely with samples of mixed milk.

A. At this centre we took 28 samples, and all were incubated at 37½ deg. C. As is to be expected, the time taken by the respective samples to form the clot, varied. The average of the recorded periods was 15.6 *hours.*

B. At this centre we took 70 samples. The temperature of the incubator varied from 36 deg. C. to 38 deg. C. The shortest period of time taken to form the clot was 15 *hours*, and the longest period occupied in clotting was 27 *hours*. The average of the recorded periods for the 70 samples was 21.4 *hours.*

C. At this centre we took 143 samples, and all were incubated at 37½ deg. C. Three samples failed to clot in 24 hours. With respect to the remaining 140 samples, the shortest period in which the clotting took place was 9 *hours*, and the longest period required for the reactions was 22

D. (a) At this centre we took 64 samples. The temperature of the incubator varied from 35.5 deg. C. to 41 deg. C. The shortest period in which the clotting took place was 24 *hours*, and the longest period required for the reactions was 48 *hours*. The average of the recorded periods for the 64 samples was 30.7 *hours.*

The number of samples upon which we are able to report is not sufficiently large to warrant our advancing any definite or final conclusions; hence the results of the

work are to be interpreted in a suggestive sense. The difficulties under which our researches are being conducted will be appreciated. While engaged in field work over protracted periods of time, it is not an easy matter to insure that the temperatures of the incubators shall be exactly uniform from day to day. Even so, during the whole of our recorded work, we find that the widest limits of variation with respect to the 'blood heat' incubator are between 35.5 deg. C. and 41 deg. C. Taking into consideration all the essential qualifications, it can be seen from our data, that the 'period of usability' of milk —and consequently the rate of spoilage of milk—is a variable entity. The 'period of usability' of milk has come to an end before the reaction of clotting is consummated. But the phenomenon of clotting is one which can be readily and easily observed; and the ratio of 'time occupied in clotting' to 'actual period of usability' can be established when researches have been pursued for a sufficiently long time under both standard and varying conditions. Milk which clots in 48 *hours* at a temperature of 98 deg. F. has a much longer 'period of usability' than milk which clots in 9 *hours* at the same temperature. For the present, therefore, it is to be desired that such procedures in methods of production and management shall be instituted, as will insure at least that all milks shall attain to our tentatively recorded 'maximum period of usability.'

The Fermentations of Milk.

Responsible for the changes which take place in milk leading to spoilage or limitation of period of usability are many types and varieties of bacteria. The most common are organisms of the *Streptococcus lacticus* (*) group (Kruse) (6) and the organisms of the *colon-aerogenes* group (Escherich. (16) (17) (18). That initial contamination, age of milk, and temperature at which the milk may be kept are conditions which affect the balance of flora is a dictum well supported by the literature. A temperature approximating to 37½ deg. C. encourages the prolification of the bacteria of the *colon-aerogenes* group, while a temperature of 21 deg. C. more readily provides for the balance of the flora being in favour of the *Streptococcus lacticus* types. It is to be expected, therefore, that the prevailing temperature at which milk is held subsequent to production, will, by reason of the above, exercise a decided influence as to the type of 'clot' formed on incubation. At the same time it must not be overlooked that the associative action of bacteria as pointed out by Marshall (13) is a factor which requires to be considered in any discussion on the organisms responsible for the 'spoiling of milk.'

* The almost invaluable functions performed by the strains of this type in the manufacturing and ripening of cheese are not in the slightest sense called in question.

The Dissolving Fermentation.

In the course of our work up to the present, we have not attempted to determine the types of organisms and relative frequency of the same in the milks after the clots have formed; but the prevalence of the type of fermentation which we have designated 'dissolving' challenged investigation. As changes in the milks submitted to the 'clotting' tests proceed, the partial or complete disappearance of the clot is evidenced in a high percentage of the samples under investigation. Usually 'dissolving' takes place concurrently with, or subsequent to coagulation; but in some cases the milks dissolve without previous clotting. That the activities of bacteria may result in the decomposition and dissolving of the casein of milk has been long a recognized prenomenon. Many references to the liquefaction of the clot in milk are to be found in the literature, and the reaction is used as one of the bases for the identification and classification of bacterial types. Dyar, (19) Conn, Esten & Stocking, (6) Rogers & Davis, (20) Lohnis, (21) Heineman, (22) Winslow, Rothberg & Parsons, (23) Degraaf & Schaap, (24) Barthel & Sandberg, (25) Rogers, (26) and others have recorded their researches into this aspect of the fermentations of milk.

The frequency with which the 'dissolving' of the clot takes place, and the fact that the reaction is common to the milks

under examination at each of the four centres at present included in our investigation, has led us to inquire further into the phenomenon. The varying periods occupied in the 'clotting' of the milk we examined are given herein on Page 214. From unpublished laboratory data we record that at Centre "A", dissolving of the clot had begun within 24 hours in 26 of the 28 samples; at Centre "B", 31 of the samples showed partial dissolving of the clot within 24 hours; at Centre "C", 128 of the 140 samples were dissolving within 24 hours; and at Centre "D", 11 samples had commenced to dissolve in 24 hours.

A Detailed Study — Centre "A".

In pursuit of our enquiries relative to the phenomenon of "dissolving" or "peptonizing" we selected centre "A" for further investigation.

Media Employed:

Beef-peptone-agar	Standard Methods (27)
Beef-peptone-gelatin	Standard Methods (27)
Beef-peptone-broth	Standard Methods (27)

Reaction of Media. The media was adjusted according to hydrogen-ion concentration, so that the final reaction was PH=7, using brom-thymol-blue or phenol-red as indicator.

Milk—Fresh milk was separated, tubed, and sterilized by heating in flowing steam for thirty minutes on three successive days.

Litmus Milk—prepared as above—*see Milk* — with the addition of sufficient azolitmin solution to give the desired blue color.

Milk + Peptone — prepared as above — *see Milk* — with the addition of 1% peptone (Difco.)

Sugar-broths — Broth consisting of peptone (Difco) 1% sodium chloride 0.5%, and water 98.5%, was prepared, tubed — Dunham tubes being inserted for the collecting of the gas — and sterilized for 15 minutes at 15 lbs. pressure. The carbohydrates used were made up separately as 10% solutions in distilled water and sterilized as above. The carbohydrate solutions were then added to the broth in such proportion that the final broth contained .5% of the required carbo-hydrate. Prior to inoculation the broths were incubated for 48 hours at 37½ deg. C. in order that any contamination might be detected. Brom-thymol-blue was used as indicator.

Nitrate broth	Standard Methods (27)
Broth for Indol Test	Standard Methods (27)

In June and July, 1920, series of samples of material for examination were taken. Observing the necessary precautions, milk was drawn direct from the udder into sterile test-tubes, the samples being obtained at successive intervals during the milking operations. In this manner, examinations were made of the milk of eleven individual cows. Samples of the mixed milk of the entire herd of thirty cows, of the water used for the washing of the utensils, of the water from the bottom of the tanks in which the utensils were washed, of the water left in the milking machine, of the butter and of the buttermilk starter were taken. Agar plates were exposed to the air of the dairy, dairy barn and feed room. Small portions of the grain, ensilage, and hay used as feed, and of straw used for bedding were procured, and inoculated direct into sterile milk. Samples were plated on beef-peptone-agar. Milks and agar plates were incubated at 37½ deg. C. and room temperature respectively. The results of the fermentation tests were found to be almost identical at both temperatures, except that the dissolving tended to be more rapid at 37½ deg. C. Of the forty-one milks submitted to the "clotting" test, thirty-six showed dissolving within from twenty-four hours to one month. The sterile milks inoculated with feed and straw dissolved. The work done was qualitative. One hundred and thirty-three cultures of organisms which dissolved the casein of milk to a greater or lesser extent were recovered from the various sources enumerated. Fifty-seven of the dissolving organisms isolated, were from the milk samples produced under aseptic conditions; some were recovered from samples taken during the early stage of milking, some from the middle milk, and some from the strippings.

Of the one hundred and thirty-three cultures, fifty-three appear to be lactic acid producing bacteria. For convenience we place these fifty-three cultures as Group 1. In milk, each strain produces a firm clean clot which begins to show dissolving in from one to seven days. Usually the dissolving begins at one side of the tube, extending throughout the entire

length of the column of milk or clot and proceeding to the point where about half of the contents of the tube remains undissolved. We have designated this dissolving as of the "lateral" type. Of this group twelve cultures were isolated from feeds and bedding; thirty strains were recovered from milk procured under aseptic conditions — four from fore milk, nineteen from middle milk, and seven from strippings; the remaining eleven strains of the group were recovered from air, mixed milk, the milking-machine and butter.

Constituting Group II, is another series of cultures, twenty in number, the majority of which appear to precipitate the casein rather than to form a clot. When a clot is formed it is soft and flaky in appearance. Subsequent digestion is stratiform and is not accompanied by any perceptible odor. Of this group, one strain was isolated from water, one from silage, one from air, and seventeen from milk samples taken under aseptic conditions; of the seventeen cultures from milk, two were from fore-milk, eleven from middle milk and four from strippings.

A third group — Group III — includes thirty-two cultures which digest the milk. The digestion begins at the surface of the milk or clot, continuing downward until only a thick gelatinous fluid remains. A pronounced putrid odor is noted in every case. Of the thirty-two strains, twelve were isolated from water, one from feeds, six from air, four from the milking machine, and five from milk produced under aseptic conditions — two from fore-milk, two from middle milk and one from strippings.

Our fourth group — Group IV — includes the remaining twenty-eight cultures. The reactions of these strains in milk are so variable that we deem it undesirable to attempt a sub-division into further groups.

TABLE I

The sources from which 133 "Milk-Dissolving" organisms have been isolated are tabulated here, and the cultures are grouped according to the mode of dissolving.

Source	Group I	Group II	Group III	Group IV	Total
Milk produced under Aseptic conditions	30	17	5	5	57
Air	7	1	6	16	30
Feeds & Bedding	12	1	1	2	16
Water	—	1	12	2	15
Mixed Milk	1	—	3	2	6
Milking-Machine.	2	—	4	—	6
Butter	1	—	1	1	3
	53	20	32	28	133

It will be observed that the groupings as specified above have been determined primarily according to the reactions of the organisms to milk. This procedure is in harmony with the prime object of the investigation. The reactions to milk and the consequent groupings were recorded when the cultures were newly isolated. The continuity of the work was interrupted at this stage, and a new laboratory was occupied and equipped. On the resumption of the investigation, it was found that of the one hundred and thirty-three cultures originally recovered, only seventy-eight were available for further examination. Of the seventy-eight strains thus remaining, thirty-two are in Group I, eleven in Group II, seventeen in Group III, and eighteen in Group IV. The seventy-eight cultures have been examined microscopically, their relation to the Gram stain determined and their reactions to gelatin glucose and lactose recorded. — See Table, page 219.

The features of the thirty-two cultures in Group I—the cultures which dissolve milk laterally — are as follows:—

(a) twenty-one strains are Gram positive cocci, fermenting glucose and lactose to acid, and liquefying gelatin.

(b) five strains are Gram positive rods: two strains ferment glucose and lactose to acid and liquefy gelatine; one ferments glucose and lactose to acid but fails to liquefy gelatin; one ferments glucose and lactose to acid and gas and liquefies gelatin; one ferments glucose and lactose to acid and gas but fails to liquefy gelatin.

(c) six strains are Gram negative rods; three strains ferment glucose and lactose to acid and gas and liquefy gelatin; two ferment glucose and lactose to acid and gas but fail to liquefy gelatin; one ferments glucose to acid, has no action on lactose and liquefies gelatin.

The features of the eleven cultures in Group II — the cultures which produce a stratiform dissolving in milk — are as follows:—

(a) nine strains are Gram positive cocci fermenting glucose and lactose to acid, and liquefying gelatin.

(b) two strains are Gram positive rods which ferment glucose to acid, have no effect on lactose, and liquefy gelatin.

The features of the seventeen cultures in Group III are as follows:—

(a) eight strains are Gram positive rods; four strains ferment glucose and lactose to acid and liquefy gelatin; three ferment glucose to acid, have no action on lactose and fail to liquefy gelatin; and one ferments glucose to acid, produces slight acidity, and later alkalinity in lactose, and liquefies gelatin.

(b) three strains are Gram negative rods: two strains ferment glucose to acid, have no action on lactose, and liquefy gelatin; one ferments glucose and lactose to acid and gas but fails to liquefy gelatin.

(c) four strains are Gram positive cocci: three strains ferment glucose and lactose to acid and liquefy gelatin; one ferments glucose to acid, but fails to attack lactose and fails to liquefy gelatin.

(d) two strains are Gram negative cocci: one strain ferments glucose and lactose to acid and fails to liquefy gelatin; one ferments glucose to acid, fails to ferment lactose and liquefies gelatin.

The features of the eighteen cultures in Group IV are as follows:—

(a) fourteen strains are Gram positive cocci, fermenting glucose to acid, and with one exception fermenting lactose to acid; all liquefy gelatin.

(b) two strains are Gram positive rods: one strain ferments glucose and lactose to acid and gas and liquefies gelatin; one ferments glucose to acid, fails to ferment lactose, but liquefies gelatin.

(c) two strains are Gram negative rods which ferment glucose and lactose to acid and gas; one strain only liquefies gelatin. — See Table II, page 219.

Note.—Chromogenesis—on agar after 14 days incubation at room temperature. The chromogenesis of the Gram positive cocci has been determined, using the Winslows colour chart. (28) Nineteen of the strains in Group Ia, eight of the strains in Group IIa, three of the strains in Group IIIc, and eleven of the strains in IVa, are recorded as Staphylococci (29). One strain in Group IVa is a Micrococcus (29. The remaining six of the forty-eight strains of Gram positive cocci failed to grow at this time.

Observations on Cultural Studies.

From the data recorded, it is evident that in this investigation, the most common type of organism responsible for the "dissolving" or "peptonizing" of milk is a Gram positive staphylococcus which ferments glucose and lactose to acid and liquefies gelatin. This statement must be qualified by a reminder of the fact that the work was qualitative, and that only seventy-eight of our original one hundred and thirty-three strains are included in the cultural determinations. It will be observed, however, that forty of the strains examined are of the type indicated immediately above—see Table II, page 219 and note on Chromogenesis. Not the least interesting feature of the work is the finding that twenty-five of the forty strains have been isolated from milk procured under aseptic conditions—the taking of adequate precautions against contamination from external sources. As our studies are not specifically concerned with the flora of the udder, we have not deemed it necessary to include in the paper the general results of our examinations of the milk of individual cows, but in our search for the dissolving organisms we have acquired laboratory records of the flora of the individual milks examined. And it is worthy of note that the "milk-dissolving" staphylococci include strains isolated from the milk of each of the eleven cows referred to on page 216. It would seem legitimate to suggest that the occurrence of these staphylococci is in harmony with the findings of researches primarily concerned with the bacterial flora of the normal udder of the cow. Bergey, (5) Conn, Esten and Stocking, (6) Harrison and Savage, (4) Harding & Wilson, (7) and Evans, (8).

TABLE II

SOURCES, GROUPING AND CULTURAL F EATURES OF 78 "MILK-DISSOLVING" ORGANISMS. (See pages 216-218.)

Plus sign signifies reaction positive.

	GROUPS 1.											GROUP II.			GROUP III.														GROUP IV.						
Milk Produced under Aseptic Conditions	14	1										8	2		2	1													4						
Mixed Milk			1														1													1					
Feeds & Bedding				3	1	1	3	2						1				1													1				
Milking Machine																			1	1															
Butter									1																										
Water																					1	2	1	2	1							1	1		
Air										4	1															1	1	1						9	1
Gram Positive Rod			+		+	+			+		+		+		+	+		+		+		+	+									+	+		
Gram Negative Rod		+					+	+																+	+					+	+				
Gram Positive Coccus	+			+						+		+		+					+		+					+	+		+					+	+
Gram Negative Coccus																	+											+							
Glucose Acid	+	+		+	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+			+		+	+
Glucose Acid & Gas			+				+	+	+																+					+	+		+		
Glucose not attacked																																			
Lactose Acid	+			+	+	+				+	+	+		+	+		+	+	+		+		+			+			+					+	
Lactose Acid & Gas			+				+	+	+																+					+	+		+		
Lactose not attacked		+											+			+				+		+		+			+	+				+			+
Gelatin liquefied	+	+	+	+	+		+			+	+	+	+	+	+	+		+	+		+		+	+		+		+	+		+	+	+	+	+
Gelatin not liquefied.						+		+	+								+			+		+			+		+			+					

The above chart summarizes the data presented o n pages 216-218. The cultures are grouped in harmony with their mode of dissolving milk and are subdivided according to the sources, morphology and cultural reactions: e g. 14 cultures of Group I, examined from "Milk Produced under Aseptic Conditions" are Gram positive cocci, acid to glucose and lactose and are gelatin liquefiers.

Included in the forty strains of staphylococci are ten strains which have been recovered from air — see page 216. Reference to pp. 217-218 shows that the staphylococci from air are of the same main type as those isolated from milk, but that their ability to dissolve milk is much less marked. The number of our strains is quite insufficient to warrant the drawing of conclusions. Yet, our results have some slight significance with respect to the relationship of the air contamination of milk during the milking operations. We do not dissent from the conclusions of Harding et al, (30) Ruehle and Kulp, (31) Ayers et al, (34), and others relating to the minor part played in the contamination of milk by organisms from the air. We record our findings but do not propose to comment thereon. It is permissible to cite the recovery by Gordon (33) of two strains of gelatin-liquefying-milk-clotting-cocci from the open air of London; and the work of the Winslows (34) in which they found aurococci from the air.

Apart from the staphylococci, we do not consider that the remaining types included in our studies, place themselves in sufficiently large groups to warrant any detailed comment. It should be noted that the cultures from feeds and bedding are principally in Group I — milk dissolved laterally — and are Gram positive or Gram negative rods; some ferment glucose and lactose to acid and gas and some, but not all, liquefy gelatin. The agreement with the work of previous researches in the isolation from feeds of lactose-fermenting strains is to be noted. (40) (41). Of the cultures recovered from water, the majority are placed in our Group III — milk digested with putrid odour. The reactions of these cultures, as shown in Table II present much variation; and the number of strains is small. Even so, the relation of the source of the organisms to the definite production by them of putridity in milk should not be overlooked.

Detailed Cultural Studies.

In pursuit of more definite information with regard to the characteristics of the organisms included in our studies, four of the strains which produced the "lateral" type of "milk dissolving", and two of the milk putrefying strains have been examined in greater detail.

Culture 63.—The characteristics of this culture, are, with very minor exceptions common to those of the four cultures, 63, 75, 86 and 122, which, by reason of the fact that they produce the "lateral" type of dissolving, have been submitted to a detailed study. The cultures were isolated from middle milk of Cow 98, middle milk of Cow 121, strippings of Cow 51, and strippings of Cow 86, respectively.

Morphology.—Microscopically cocci occurring singly and in irregular groups, varying in diameter from .4 u. to 1.4 u, the majority about 1 u; non motile; staining well with Kuhné's methylene blue; Gram positive.

Cultural Characteristics:

Agar Stroke at 37½ deg. C. In 24 hours growth moderate along track of needle, beaded, glistening, yellowish by transmitted light.

Gelatin Stab at Room Temp.—In two days no apparent growth; in 6 days beaded growth along line of puncture, growth best at bottom of stab, yellow; in 18 days liquefaction begun, infundibuliform; in one month liquefaction complete.

Nutrient Broth at 37½ deg. C. — In 24 hours iridescent ring at surface, Strong clouding, caramel odor, sediment scanty, viscid on agitation; in 3 days no odour.

Agar Colonies at 37½ deg. C. — In 48 hours growth moderate, surface colonies .75 to 1 mm. in diameter, circular, smooth, flat, yellowish; amorphous structure. Deep colonies, torpedo shaped, varying in length to .75 mm., distinctly yellow. Under low power objective, compact and very finely granular.

Gelatin Colonies at Room Temperature. (1st appearance) in ten days minute colonies; in 20 days circular surface colonies varying in diameter, to 1 mm., smooth, flat, yellow; amorphous structure; liquefaction, cup shaped, 2 mm. in diameter; subsurface colonies, small about .25 mm. elliptical, yellow.

Physiology:

Milk at 37½ deg. C. — In 24 hours, clotted, beginning to dissolve "laterally" faint caramel odor; in 48 hours one-third dissolved; in 72 hours one-half dissolved, fluid later becoming clear and colourless; in 21 days three-quarters dissolved, the solution yellow; in one month no further dissolving and no odor to be noted; white

granules float in the liquid and also are to be seen attached to the remaining curd.

Litmus Milk at 37½ deg. C. — In 24 hours acid; distinctly acid after one month. In this medium the reactions are identical with those recorded above — see milk at 37½ deg. C. — except that the litmus appears to exert a slightly inhibitive effect on the activity of the organism.

Milk + Peptone. — In this medium the reactions are identical with those recorded above — see milk at 37½ deg. C. — except that the dissolving proceeds at a more rapid rate.

Temperature Relations.—Thermal death point 10 minutes exposure in nutrient broth at 58 deg. C. Optimum temperature 37½ deg. C.; cultures incubated at 37½ C., and room temperature respectively.

Chromogenesis. — In nutrient broth at 37½ deg. C., no pigment in one week. In nutrient gelatin at room temperature, yellow along track of needle in 6 days. On nutrient agar at 37½ deg. C. surface colonies pale yellow; deep colonies brighter yellow in 2 days. On potato, in 24 hours 37½ deg. C., pale yellow. Growth from agar slants, which had been incubated for two weeks at room temperature, spread thickly on white paper and dried, matched Cadmium Orange Chrome IV of the frontispiece of "Systematic Relationships of the Coccaceae" by Winslow and Winslow (28).

Relation to Oxygen. Facultative anaerobe.

Biochemical Reactions. Indol not produced. Nitrates not reduced or only to a very slight degree.

Fermentation of Carbohydrates. — Dextrose, lactose, galactose, saccharose, levulose, maltose, mannite, raffinose, and glycerin are fermented to acid within 24 hours. The reaction to mannite and raffinose is but slight. Inulin is not fermented. Gas is not produced from any of the carbohydrates used.

The characteristics of this organism which have been determined, lie within the variations included by Conn, Esten and Stocking in the type *M. lactis varians,* (6) noted by them as the most common coccus found in milk, and frequently present in milk directly from the udder. These workers were led to consider that their type was the common *Staphylococcus pyogenes aureus,* and therefore in harmony with the more recent classification of the Comm. of the Society of Amer. Bact. (29) and of Winslow, Rothberg and Parsons, (23) and following Buchanan (35) the Culture 63 is to be classified as of the type *Staphylococcus aureus* (Rosenbach).

Culture 126, isolated from middle milk of Cow 135, is a rod with rounded ends occurring singly or in chains; variation in size is shown, according to the age of the culture and the medium employed. The organism is Gram positive and forms spores. From the condensation water of agar, young cultures are actively motile.

On *agar* at 37½ deg. C., the growth is luxuriant and spreading. At 21 deg. C. *gelatin* is liquefied, stratiform. In *milk* at 37½ deg. C. no apparent change can be noted in 24 hours; in 48 hours there is a soft clot beginning to dissolve stratiform, with no odor; in 6 days the dissolving has proceeded to the extent of three-fourths of the whole, and a putrid odor can be defined; later, a sweet putrid odor is noted, and in two months a pronounced "beef extract" odor is apparent. In *litmus milk* at 37½ deg. C. the reactions proceed as above; as indicated by the litmus, acidity is first noted, bleaching then takes place, and later, distinct alkalinity is evident. In *milk + peptone at* 37½° C., the reactions are very similar to those recorded for *milk.* In *milk* at room temperature, dissolving is less rapid than at 37½ deg. C. but is completed in 24 days. In *milk* at 15 deg. C. the dissolving is delayed; in four weeks, slight dissolving can be noted, with a putrid odor; later a soft clot is formed which in 7 weeks is one-half dissolved. In dextrose, lactose, galactose, saccharose, levulose, maltose, mannite, raffinose, glycerin, and inulin, acid is formed within 24 hours. The reactions to galactose, mannite and inulin, are slight. Gas is not produced.

After a detailed study of the morphology, method of sporulation, size, shape and position of the spore, the reactions to gelatin, litmus-milk, glucose, lactose and saccharose broth, and to glucose-litmus-agar, we consider this organism identical with the strain classified by Lawrence and Ford (36) as *Bacillus albolactis* Migula.

Culture 127, isolated from fore-milk of Cow 56, is a Gram positive rod, without endospores, occurring singly or in chains and showing great variation in morphology according to the age of the culture, and

nature of the medium employed. From the condensation water of agar, young cultures are actively motile. Stained by Van Ermengem's method, the flagella proved to be peritrichic.

The liquefaction of gelatin is stratiform with no putrid odor and is complete in one month. In *milk* at 37½ deg. C. the reaction is possibly more correctly described as digesting than dissolving; within 48 hours digesting commences, and in 14 days a gelatinous pencil clot is noted, and a definitely putrid odor; later, a brilliant red fluid, having a pronounced "beef extract" odor is recorded, and this condition persists for at least two months. *Litmus milk* at 37½ deg. C. is digested; in 21 days, a marked turnip odor is apparent, and in one month the "beef extract" odor already noted, is definite. In *milk + peptone* at 37½° C. no colour is developed, the "beef extract" odor is less marked, and otherwise the reactions are common to those recorded for *milk*. In *milk* at room temperature, the reactions are slower than those detailed for milk at a temperature of 37½ deg. C., but in two months the medium is almost completely digested, and an odor of "beef extract" is definite. The organism is killed on exposure to a temperature of 58 deg. C. for 10 minutes. Dextrose, saccharose, levulose, mannite, raffinose, and glycerin, are fermented to acid within 24 hours. The reaction to raffinose is slight. To lactose and galactose the reaction is first faintly acid, later alkaline. Maltose and inulin are not fermented.

This organism closely resembles B. *cochleatus* Conn, Esten and Stocking, (6) varying in that the colonies on gelatin are simple not lobed, the liquefaction of the gelatin stab is stratiform, the growth on agar is white and spreading. The characteristics of Culture 127 closely resemble those determined for our Culture 126, with the unsurmountable exception that Culture 127 does not form spores. The failure to produce endospores excludes this strain from the *Bacillaceae* (29). Automatically it is included among the *Bacteriaceae* (29) and the cultural reactions seem to infer a place between the Tribe *Zopfeae* (29) and the Tribe *Bactereae* (29). Hence our strain becomes a variation of the Genus *Zopfius* on the one hand and of the Genus *Proteus* on the other hand. The variations of the strain from either are distinct and definite, Wenner & Rettger. (37), Enlows, (38). We suggest the placing of Culture 127 as a strain intermediate between the genera *Proteus* (29) (37) (38) and *Zopfius* (29) (37) (38).

General Summary.

An investigation into the spoilage of milk and the possible "period of usability" of milk was commenced in the Province of British Columbia some two years ago, and the work is still in progress. The classic laboratory methods for the determination of the bacterial content of milk have been used, but our principal activity has been the conducting of "clotting" experiments by the adoption of the "Fermentation Test". Our paper reports work on three phases of the investigation:—I. milk clotting tests: II. a more or less detailed treatment of the "dissolving" or "peptonizing" fermentation, and III the cultural characteristics leading to the classification of certain of the organisms isolated during the research.

1. Milk clotting tests have been carried on at four centres. The records of two hundred and forty-five samples are submitted. Incubated at 37½ deg. C. the shortest period occupied in clotting was 9 hours, and the longest period 48 hours. The data presented is concerned solely with samples of mixed milk. The number of samples reported upon is not sufficiently large to warrant more than tentative conclusions. For the present it is to be inferred that such procedures in methods of production and management shall be instituted as will insure at least that all milk shall attain to our tentatively recorded "maximum period of usability." The relationship of "time occupied in clotting" to "actual period of usability" is referred to on page 215.

II. The frequency with which at each centre the "dissolving" or "peptonizing" of the clot took place led to further enquiry into this phenomenon, and one of the four centres was selected for the more detailed studies. Samples of milk drawn direct from the udder into sterile test tubes — observing the necessary precautions — samples of mixed milk, of water, of feeds and bedding were taken; and agar plates were exposed under varying condi-

tions. The work done in II was qualitative. One hundred and thirty-three cultures which dissolved milk to a greater or lesser extent have been recovered. On page 217 a description of the type of dissolving is given and the grouping of the cultures according to the mode of dissolving milk is presented. On page 217 Table I the sources from which the milk-dissolving organisms have been isolated are tabulated. The propriety of grouping our cultures according to their reactions to milk may be questioned from the systematic standpoint. The procedure however, is in harmony with the prime object of the investigation —the securing of data with respect to the spoilage of milk. It is noted on page 217 that a break in the continuity of the work left us with only seventy-eight of the one hundred and thirty-three cultures available for further examination. On pages 217 to 218 certain features of the seventy-eight cultures are recorded, and on page 219, Table II, the sources, grouping, and cultural features of the seventy-eight milk-dissolving organisms are presented in tabular form. It will be observed from our "observations on cultural studies," page 218, that in this investigation, the most common type of organism responsible for the dissolving or peptonizing of milk is a Gram positive staphylococcus which ferments glucose and lactose to acid, and liquefies gelatin. More than fifty per cent of the staphylococci are from milk procured under aseptic conditions, and the series includes strains from the milk of each of eleven cows. See qualification on page 218.

III. Six of the seventy-eight strains have been examined in greater detail. Cultures 63, 75, 86 and 122 — isolated from middle milk of Cow 98, middle milk of Cow 121, strippings of Cow 51, and strippings of Cow 86, respectively — are each classified as of the type *Staphylococcus aureus* (Rosenbach) (29). Culture 126, isolated from middle milk of Cow 135 is classified as *Bacillus albolactis* (Migula) (36). Culture 127, isolated from foremilk of Cow 56, is placed intermediate between the genera *Proteus* and *Zopfins* (29) (37) (38).

CONCLUSIONS.

At the present juncture of the investigation, and with the limited amount of data at our disposal, we do not feel justified in drawing definite conclusions.

There is, however, sufficient evidence to warrant the suggestion that in certain cases the time occupied by milk in clotting is much shorter than can be considered to be legitimate. As yet no correlation of the "time occupied in clotting" with the "actual period of usability" of milk is presented. Nevertheless the phenomenon of clotting may be regarded as a guide to the comparative period of usability of (a) various individual milks (b) milks produced at various specific centres. The extending of the period occupied by clotting and hence the extending of the period of usability of milk is an accomplishment within the reach of all those engaged in the production and management of milk for sale.

Further, it would seem that the results we have recorded permit of the tentative suggestion that the organisms recovered from the milk procured direct from the udder—even when adequate precautions are taken against external contamination—are not without significance with respect to responsibility for the spoiling of milk, particularly the spoilage which is the result of or accentuated by the dissolving or peptonizing fermentations of milk.

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The Influence of Light and of Fluctuating Temperatures on the Germination of *Poa Compressa* (L) *

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The experiments reported in this paper were conducted in October and November 1915, but have not been heretofore described for publication.

Previous to 1915 the satisfactory germination of seed of *Poa compressa* (L) in the Canadian Seed Laboratories was more or less uncertain. Samples which from external examination appeared to be vital seed, sometimes germinated 10 or 20 per cent. Other similarly appearing samples germinated 50 or 60 per cent. Moreover, the same samples when retested frequently gave results varying widely from the results of the original tests. From general observations it was believed that sunlight and fluctuating temperature conditions were beneficial to the germination of this seed but no definite data had been obtained, and as no literature dealing with the effects of these two factors was available, the writer undertook experiments in October 1915, with a view to studying this question to some extent.

Influence of Sunlight.

An experiment to study the influence of sunlight on the germination of Canada Blue Grass may first be described.

From each of twelve samples which had been stored in the Seed Laboratory for at least one year, and which in previous tests had given very low results, two lots of two hundred seeds were indiscriminately counted out, one lot to be germinated in the alternate sunlight and darkness of the natural day, and one in continuous darkness, other conditions being identical as nearly as they could be maintained. To secure these conditions an apparatus was devised, a cross section of which is shown in Figure 1. The surface of the soil in this box was marked off by double strips of tin into long narrow areas, each about five-eighths of an inch in width. The alternate spaces were covered with heavy pieces of blue blotting paper as shown, while the remaining spaces were left uncovered. Lots of seed from the samples were placed on the soil in covered (dark) spaces, while the duplicate lots were placed on the soil in the adjoining uncovered (light) spaces. The ends of the covered spaces were also completely darkened. Thus each sample was represented by two tests, side by side,

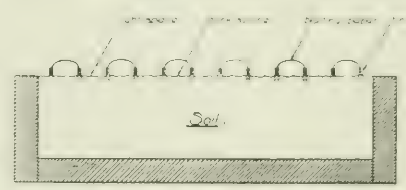

Fig 1 Cross-section of apparatus used in investigation of the effect of sunlight on the germination of Poa compressa (L)

one in alternate light and darkness and the other in continuous darkness. It was thought that the temperature variations in the covered and uncovered spaces could be kept more nearly parallel by arranging the spaces in long narrow strips, as by this arrangement heat originating from the sunlight in the light areas would conduct readily to the nearby dark areas, and thus practically parallel temperatures in the two areas would be maintained.

The box was placed daily in a south window of the laboratory from 9 a.m. till 5 p.m. in such a way as to obtain a maximum of sunlight. From 5 p.m. till 9 a.m. it was kept in a germinator of the Hamburg type, the temperature of which ranged from 30 to 35 degrees C. at 5 p.m. to about 25 to 30 degrees C. at 9 a.m. the next day. The soil was kept moist continuously by sprinkling and the temperature of the soil in the box was recorded daily at 9 a.m., 10 a.m., 12 noon and 5 p.m. Some notion of the temperature changes to which these

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* This paper is published by permission of the Dominion Seed Commissioner under whose authorization the experiments here reported were conducted.

tests were subjected may be had from Figure 2, which represents changes as recorded for slightly over one week. While this is but a section of the entire curve, it is typical and illustrates in a general way the temperature changes.

The counts made of germinated seeds are indicated in Table 1.

Sample Number	Light Conditions	COUNTS 6th day	10th day	14th day	21st day	28th day	35th day	Totals	Per cent
1	Dark	37	46	17	7	3	5	115	57
	Light	17	70	26	13	3	1	130	65
2	Dark	37	39	25	8	3	4	116	58
	Light	16	46	38	23	5	2	130	65
3	Dark	49	27	15	8	2	0	101	51
	Light	14	66	28	21	2	3	134	67
4	Dark	31	48	19	8	0	2	108	54
	Light	12	52	30	15	2	3	114	57
5	Dark	25	27	15	14	0	3	84	42
	Light	21	41	27	13	5	3	110	55
6	Dark	8	18	17	9	2	4	58	29
	Light	6	27	37	10	3	3	86	43
7	Dark	3	6	19	10	4	2	44	22
	Light	0	29	23	14	1	4	71	36
8	Dark	7	12	11	4	7	4	45	23
	Light	7	20	25	17	7	0	76	38
9	Dark	7	36	29	9	8	7	96	48
	Light	3	48	37	32	1	8	135	68
10	Dark	38	22	20	5	3	5	93	46
	Light	18	57	27	13	7	2	124	62
11	Dark	25	29	17	5	5	4	85	43
	Light	11	51	22	15	1	8	108	54
12	Dark	13	20	11	10	1	2	57	28
	Light	2	20	28	23	6	7	86	43
Aver-	Dark	23.3	27.5	17. 9	8	3.1	3.5	83.5	42
ages	Light	10.5	44	29	17.4	4	3.6	108.6	54.3

Table I — *Poa Compressa* (L). Results of germination tests conducted in darkness continuously, and alternately in light and darkness.

In examining this table it will be noticed that in all cases except No. 8 the six day count is higher for tests conducted in continuous darkness than for those subjected daily to light. In No. 8 the count is 7 in both cases. It is rather singular, if light has a beneficial effect in the germination of Canada Blue Grass, that the 6th day count was higher for tests in the dark continuously, than for those alternately in light and darkness. An explanation of this peculiar result is not here attempted. It will, however, be noticed in the table that the final percentage germination is higher for tests subjected alternately to light and darkness than for those subjected to darkness continuously. This result obtains for every one of the twelve samples. The greatest difference is 20 per cent, shown in No. 9, and the lowest 3 per cent., shown in No. 4, while the average for the twelve samples is 12.3 per cent(see curves in Figure 3). While this is not a great difference, still when it is considered that an advantage in favor of light is shown with all the samples, it may reasonably be concluded that sunlight was responsible for the somewhat increased germination.

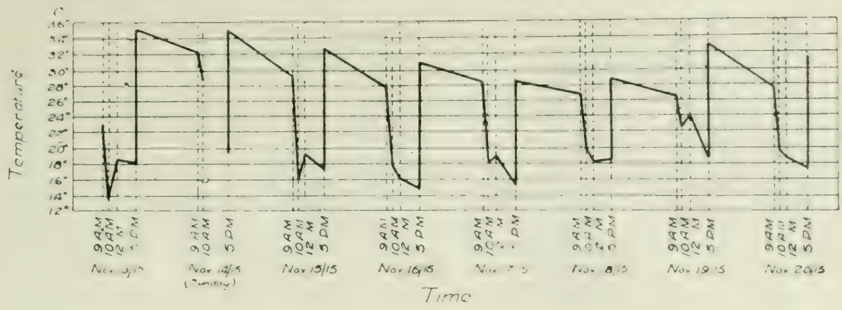

Fig 2 Germination of Poa compressa (L)
Showing temperature changes in light experiment

Influence of Fluctuating Temperatures. Simultaneously with the above tests another experiment was conducted for the purpose of comparing the effect of approximately steady temperatures with fluctuating temperatures of different ranges and extents of range. The same twelve samples were used, and for each test two hundred seeds were taken indiscriminately from each sample. The seeds were placed on the surface of soil which was kept moist by sprinkling throughout the period of the test. Five standard dark germinators were used. Adjustments of heat conditions were so made that these germinators maintained approximately steady temperatures of 16 deg. C., 25 deg. C., 30 deg. C. and 35 deg. C. respectively. A set of seeds from each of the twelve samples was placed in each of these germinators and kept there continuously for thirty-five days, this being the period of time allowed for the experiment. In this way provision was made for the tests being carried out at the different steady temperatures above mentioned. In these germinators, by changing tests from one to another, the following temperature fluctuations were also provided: 16 deg. C., to 20 deg. C.; 16 deg. C. to 25 deg. C.; 16 deg. C. to 30 deg. C.; 16 deg. C. to 35 deg. C.; 20 deg. C. to 25 deg. C.; 20 deg. C. to 30 deg. C.; 20 deg. C. to 35 deg. C.; 25 deg. C. to 30 deg. C.; 25 deg. C. to 35 deg. C.; and 30 deg. C. to 35 deg. C. Sets of seeds representing the twelve samples were prepared for transfer according to the range and extent of range of fluctuation desired. The transfers were made so that the samples were subjected to the higher temperatures from 9 o'clock a.m. until 5 o'clock p.m. of the same day and remained at the lower temperatures during the remainder of the twenty-four hours.

Figure 4 is a representative section of the curves intended to illustrate the temperature changes to which all of these tests were subjected. The five approximately horizontal lines, numbers 1, 2, 3, 4 and 5, represent the five steady temperature changes. For example, the lowest, num-

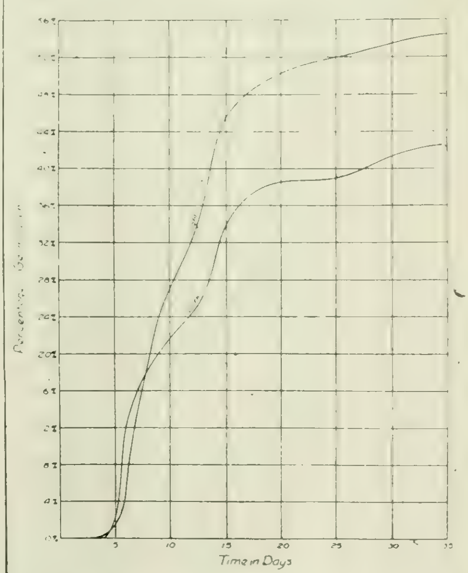

Fig 3 Germination of Poa compressa (L)
Results of tests in continuous darkness and alternately in darkness and light

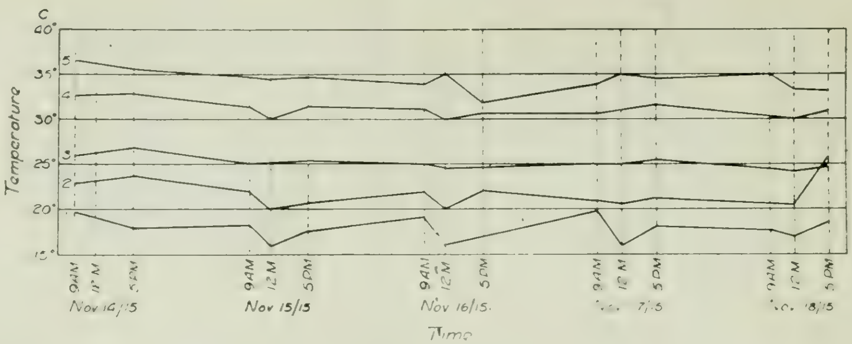

Fig. 2 Germination of Poa compressa (L)
Showing steady and fluctuating temperature changes

ber 1, indicates the temperature changes of the germinator intended to be kept as nearly as practicable at 16 deg. C. Fluctuating temperatures are also illustrated in a comparative way on this chart. For example, the fluctuation between 25 deg. C. and 30 deg. C. for the day of November 14th, 9 a.m. to 5 p.m., is indicated on curve 4, and during the following night, 5 p.m. to 9 a.m., on curve 3. At 9 o'clock, November 15th, it again changes back to curve 4, remaining until 5 o'clock of the same afternoon, when it is again transferred to curve 3, and so on to the end of test. The vertical dotted lines at 9 a.m. and 5 p.m. thus represent the changes of temperature, brought about by the transfers from one germinator to the other. Other fluctuations are similarly illustrated in this figure.

In all, one hundred and eighty tests were made in this experiment. Counts of germinated seeds were recorded on the 6th, 10th, 14th, 21st, 28th and 35th days of incubation. The averages of the counts of the twelve samples under the same germination conditions were calculated, and appear on Table II. As two hundred seeds were used for each test, the average percent germination is just half the average total.

Average counts made on 12 samples on:

Temperature Conditions	6th day	10th day	14th day	21st day	28th day	35th day	Average Percent	Average Totals
16 C	.08	2.50	1.58	1.00	.67	.16	5.99	2.99
20 C	.75	2.25	1.42	.83	.08	.08	5.41	2.70
25 C	1.75	10.08	2.00	1.25	.17	.00	15.25	7.62
30 C	2.42	4.92	.66	.16	.33	.00	8.49	4.24
35 C	.42	1.92	1.16	.83	.75	.00	5.07	2.53
16—20 C	.83	6.17	4.25	15.60	1.00	.33	28.08	14.04
16—25 C	3.58	30.75	13.33	7.08	1.25	.16	56.16	28.08
16—30 C	6.08	75.16	17.75	4.33	1.50	.08	104.90	52.40
16—35 C	4.75	90.92	8.25	3.96	.58	.16	108.62	54.31
20—25 C	3.25	6.33	1.16	1.00	.16	.00	11.91	5.95
20—30 C	9.16	37.66	12.83	8.08	2.33	1.58	71.64	35.82
20—35 C	27.50	55.08	12.25	2.41	.42	.33	98.00	49.00
25—30 C	4.08	12.91	4.16	7.58	1.66	4.41	34.80	17.40
25—35 C	7.60	13.00	7.63	12.81	1.18	3.00	45.20	22.60
30—35 C	2.33	6.00	2.58	1.41	.41	.00	12.70	6.35

Table II.—*Poa Compressa* (L)—Germination results showing effects of Fluctuating and Comparatively Steady Temperature Conditions.

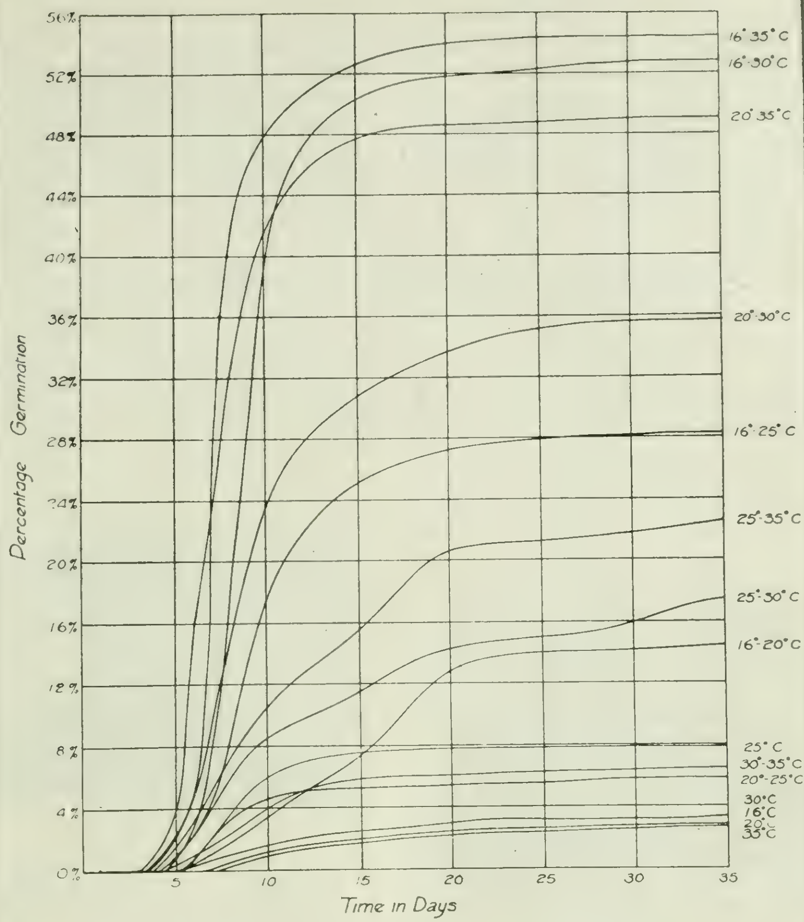

Fig 5 Germination of Poa compressa (L.)
Effects of steady and fluctuating temperature conditions

The tabulated results in Table II show the effects of these different temperature changes, but these effects are more readily appreciated from an examination of the curves in Figure 5. In this figure the abscissa represents time, and the ordinate percentage germination.

The nine lowest curves represent the results obtained at steady temperatures and where fluctuations of five degree C. occurred. In none of these cases did the germination percentage rise to 18. The next three higher curves show results obtained with ten degrees C. fluctuations, the percentage ranging between 22 and 36. Next higher are two curves, representing results where the fluctuation was 15 degrees C., the percentages ranging between 49 and 53. The highest curve showing a germination of 54.3 per cent. illustrates the effect of a fluctuation of approximately 20 degrees.

These curves present clearly the conclusion that may be drawn from this experiment, viz., the greater the extent of the fluctuation of temperature between 16 degrees C. and 35 degrees C., the higher the germination percentage. It may be that a greater fluctuation would give higher results, but tests have yet to be made to determine this point. These percentages, even the highest of them, may seem low, but it must be remembered that the tests

were conducted in the dark continuously and that the seeds were taken indiscriminately for test. Had those samples which gave the best results also been given the advantage of sunlight, and had only seeds containing caryopses been selected, (commercial seed of *Poa compressa* usually contains a considerable percentage of empty glumes) higher germination percentages might have been obtained.

Summary.

1.—Sunlight was found to be somewhat beneficial in germinating *Poa compressa* (L.)

2.—Daily fluctuating temperatures gave better results than steady temperatures.

3.—Daily fluctuations ranging between 16 degrees C. and 35 degrees C. are probably the best temperature conditions for germinating *Poa compressa* (L.)

Developments in Farm Machinery

The question of dusting versus spraying for insect and fungous control has been a particularly controversial one during the past decade. Both methods appear to have their own peculiar advantages and disadvantages, and each no doubt is deserving of the fullest support and development. Dusting is a comparatively new institution and

there are few dusting machines on the market today that have been given sufficient expert trial to warrant safe recommendation. The principal claims in favour of dusting appear to be (1) that a given area can be covered with much less time and with less labour, (2) that the foliage receives a more uniform covering and (3) that it possesses greater adhesive powers.

The machine shown above is made at Mahone Bay, N.S. by the Perfect Spray and Dusters, Ltd. We believe it is the first power duster made in Canada. The same company has been manufacturing a hand duster for several years. The new power duster illustrated above has the agitator fastened to the drive shaft which passes through the dust hopper. This saves an appreciable amount of mechanism and power. In spite of its high air pressure, the dust is discharged with little diffi-

culty (100 lbs. can be discharged in 8 minutes.)

Some very important developments in the control of sucking insects by means of the power duster, may be expected during the present year, as good results have already been achieved with comparatively crude machines.

O. A. C. ALUMNI MEETING.

The first annual meeting of the Provincial O. A. C. Alumni Association is to be held at London, Ontario, on March 10th and 11th. A banquet will take place at the Tecumseh House on the evening of March 10th and business sessions will be held at Hyman Hall.

Arrangements are in the hands of Mr. S. E. Todd, Secretary.

Economics of Production and Marketing of Farm Products in Canada*

By A. LEITCH,
Ontario Agricultural College, Guelph.

All will agree that the subject allotted to this paper is quite broad and comprehensive, that it offers a wide field for academic discussion and a narrow range of unanimous agreement on rule and fact. One may therefore be pardoned for limiting the discussion of this subject on this occasion to a very few outstanding features, which, though they may permit of considerable argument, have yielded to practical solution on the application of research and experience in the science of agricultural economics.

Before entering into a discussion on these specific matters, let us candidly admit that economic science is the last and latest of the sciences allied with agriculture to be applied to the solution of agricultural problems. The chemist, the physicist, the botanist, the entomologist, and the geneticist have each expanded and made to flourish their own separate provinces. These separate provinces have been held together in that greater federation or dominion, the farm, not by a conscious and deliberate application of the governing and guiding force—economics, but by the unconscious and instinctive workings of experience. The final result in the main is just as happy as though an exact knowledge of economics had been applied to the development of our farm business organization of to-day, for there is nothing on earth safer as a guide to proper organization than an instinct developed through centuries of experience in a business like farming, which, no matter how methods and technique may have changed, no matter how wonderful and world wide has become the distribution of his products, within the past century has always been and still is being conducted under the same basic organization, as a family owned and operated proposition to which the family supplies all of the supervision, the great proportion of the labor, the tools of production, in this country the ownership of the land, and to which the farm supplies the home, a great part of the necessaries for subsistence and continuous employment whether times be good or bad.

This brings us to a consideration of one of the features indicated in the opening sentences of this paper. The business of production and the business of marketing, each with its social ramifications, are the two reasonably well defined fields of applied agricultural economics. Both fields are as yet comprised of practically virgin soil. It is plain that both fields need immediate cultivation. It is well therefore to decide as to which field contains the best possibilities for an early and abundant harvest of practical benefits to the operating farmer. This problem confronts all who are interested in seeing that the science of economics takes its proper place with its sister sciences in the guidance of agricultural development. To take its proper place economics must show by its works, by a volume of good practical results accomplished, that it justifies the faith of its supporters that it is the centre round which other applied sciences revolve.

In what field therefore lie the greatest possibilities for immediate good? In production or marketing? It would appear that the answer is partly indicated in a previous paragraph where it is intimated that we have reached a large degree of economic efficiency in farm production without conscious and deliberate application of economic science. So far this is quite true but it is obvious that the agricultural world is always undergoing economic change, and that such change can be more accurately guided by known economic principles without waiting for experience, with its delays, disappointments and expenses to the individual, the community and the state, to work out the new basis of organization. Instances may be enumerated of schemes inaugurated by governments, other public bodies and even private individuals for assisting land settlement and other farming enterprises, during the war and reconstruction periods. Most of these

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* Paper read before Section O (Agriculture) of the American Association for the Advancement of Science, Toronto, December 28, 1921.

were conceived in the best of faith, for worthy objects, were honestly and conscientiously administered but failed disastrously, not on account of faulty method but because they were in direct violation of economic law. In extenuation it must be pointed out that these economic laws were not clearly understood, solely for lack of scientific investigation of the principles involved. It might also be mentioned that our Dominion Soldiers' Settlement officials have found it necessary to revise some of their original ideas and regulations on the basis of principles discovered in recent economic investigations. These revisions have furthered the success of the scheme particularly in these trying days of deflation and depression.

Furthermore, scientific analysis of farm business is necessary to acquaint the consuming public with the true financial condition of the industry which supplies its basic need, food, while the farmer world is entitled to the fullest opportunity to put before the consuming world its advantages and troubles, its profits and losses, in the manner best understood by the public i.e. dollars and cents. The individual farmer must have access to authoritative information as to the actual financial benefits that may accrue to his whole farm business from the inauguration of methods and practices indicated by research and investigation in the other agricultural sciences. The operating farmer must be apprised of the part played by such factors as size of farm, specialization, intensity of business, distribution of capital, and land value in the successful operation of his farm as it now exists, or as it may have to become, because of economic changes brought about by increasing populations, rising land values, and adaptability of land and locality to new types of farming. Governmental and other public bodies and farmer co-operative institutions engaged in financial schemes for the advancement of the material, mental, or moral welfare of the farm community must have full knowledge of the resources available in the community for the furtherance of these schemes in order that these schemes may be soundly and permanently established.

The above itemized information, in addition to much more not herein mentioned, can be procured only from scientific investigation of actual farm business, from orderly and logical compilation of essential farm data, broad generalization, careful classification and practical deduction of essential principles of this accumulated data. This would appear to be extremely important, necessary work and fruitful of much good result in the direction of the business of farm production along its proper course.

Let us now look to the prospects for good to be accomplished from investigation into the marketing and distribution field. Sound argument can be advanced for the necessity of the farmer embarking into this field of endeavour. Let me point out one or two of the fundamental reasons. First, the commercial distributor has a viewpoint essentially different to the farmer on the question of volume of production. He naturally prefers to handle 10 units of any commodity at a profit of 10 cents per unit than 100 units at 1 cent margin. The farmer who can get larger profits only by increased production naturally demands that the distribution system be based on the 100 units at one cent profit per unit. These viewpoints can be reconciled only by the farmer assuming a larger share of the burden of distribution. Of equal importance is the necessity of the farmer getting for himself a share of the profits, both financial and mental, that arise in the business of marketing. The financial profits he must have in order that he may have some surplus out of which to provide himself with those material and intellectual benefits which are so necessary in making the farm as agreeable and satisfying a place to live as the city. The mental profits or more correctly speaking the mental stimulus that accrues from marketing he must have in order that he may be properly equipped with initiative and skill to solve the problems growing out of farm isolation, rural depopulation, and all associated disadvantages under which farming is known to labour. There is no doubt that the material and intellectual attractions which city life affords have been supplied and supported in a large degree by the profits and by the mental stimulus that have arisen from the business of marketing farm produce. It becomes necessary therefore that at least a fair share of them should be regained by

the farmer, it being only too plainly apparent that he, and he only, can permanently remove the difficulties under which he labours. Participation in marketing will supply him the material and mental sinews of war with which to do it.

If it be therefore admitted that taking a leading part in the business of marketing his product, is advantageous, what are the possibilities for his success in his field of endeavour? Let it be pointed out that this is a practically new field for him. He is not as fully equipped with a natural instinct for modern business bred of the experience of generations, as he is in the production field. Moreover modern business has in itself no background of history to create, even among the rank and file of those now engaged therein, an instinctive ability to follow the proper course. It becomes doubly necessary therefore that the farmer, advancing of necessity into this field, be supplied with all the assistance and guidance that it is possible to give him. The basic principles of business, and the fundamentals particularly of marketing organization must be discovered and put at his command. This work is the duty and the very essential and immediate duty of the trained agricultural economist. Much immediate harm, trouble and loss may be incurred, in fact much has already been incurred within the past few years, by farmer's co-operative enterprises, which have failed or nearly failed through a lack of knowledge of the economic laws guiding successful business. To avoid the many pitfalls lurking in the course of marketing business the farmer and his group enterprises must be provided with necessary information derived, not from superficial and conjectural examination of so-called successful business, but from a scientific and analytical discovery of the basic economic laws governing successful business. In a general sense he must have information on world market conditions, and world sources of supply and demand for specific farm products. In a more particular sense he must be plainly shown the importance of preparation, grading, handling, transportation and storage of his products, and the costs and difficulties of these essential services. As his marketing enterprises are likely to be essentially co-operative in character, the basic features of organization, government, size, membership cohesion, contract of supply, and most important of all, finance of co-operative enterprises must be placed at his command.

These several features are all possible of attainment by orderly, logical, and practical investigation and research. Modern business may not be old in years, co-operative marketing by farmers and other groups is only at the threshold of a new but promising life, but enough has been done in both fields to provide a wide experience in both success and failure, an experience sufficiently wide in both success and failure, if clearly analyzed and crystalized, to permit of conscious and deliberate application in shaping the destiny of successful farmer operation of the business of marketing to which the Canadian farmer is rapidly approaching.

Therefore, it would appear that the greatest opportunity for immediate good results that will help to establish economic science on its true footing as the greatest aid that the farmer can have, lies in the field of distribution. Admitting that the field of production also provides such great opportunity of good practical assistance that it can not be longer neglected, let me point out that the long history of farm production has provided a saving economic instinct, while the infancy of marketing demands a guiding force scientifically evolved out of its short past experience, by the efforts of economic science.

THE OUTLOOK FOR DAIRYING.

Two addresses delivered by Mr. J. A. Ruddick, Dominion Dairy and Cold Storage Commissioner, before the last annual conventions of the Eastern and Western Ontario Dairymen's Associations, have, by request, been published by the Department of Agriculture at Ottawa in pamphlet form and can be had on application to the Publications Branch of the Department. One deals with the Outlook for Dairying in Canada, and in doing so tells of what is being done by countries that are our rivals in the British market, and what advances are necessary if Canada is to successfully compete with them. The other address deals with the Marketing of Dairy Produce.

Diseases of the Potato

By B. T. Dickson,

Professor of Botany, Macdonald College.

(*Continued.*)

Group 5.

Disease Caused by an Ascomycete. Wilt and Stem-Rot or Stalk Disease.

Sclerotial diseases of the potato have been reported from many countries within recent years. That known as "stalk disease" caused by *Sclerotinia sclerotiorum* is common in the West of Ireland and in the northern damper parts of England and Scotland. Growers believe that it is the most serious potato disease in these districts next to Late Blight. A similar disease caused by the same fungus attacks tomato, artichoke, sunflower, bean, squash, cucumber, carrot and turnips (Cotton, A.D.) in Great Britain. Bisby has reported a sclerotial disease of sunflower from Manitoba which is common also in Quebec and elsewhere. MacAlpine found a sclerotial disease of potato in Australia, which he attributed to *S. sclerotiorum*, Carpenter one in Hawaii caused by *S. Rolfsii*, and Pole Evans reports one from South Africa. During the summer of 1921 Mr. O. W. Lachaine found 10 per cent infection of a 4 acre field of potatoes in Restigouche County, New Brunswick, and four other fields of 3 or 4 acres had from 1 per cent to 2 per cent infection. The photograph (Fig. 11) is from Lachaine's material. Happily the disease according to present indications does not appear to be serious on potatoes in this country although more work must be done on it to determine this authoritatively.

Symptoms.

The first signs of the disease are patches of whitish mycelium on the outside of the potato stem at, or just above, ground level. If the weather is humid profuse mycelial growth occurs with the later development of external sclerotia. At first these are whitish, turning black and finally falling to the ground. At the same time the mycelium gradually penetrates the inner tissues reaching to the pith. In the pith rapid growth takes place with the formation of internal sclerotia. These are well shown in Fig. 11. If moist conditions prevail the stem will by this time have wilted and in many cases have fallen over, collapsing at the affected part. On the other hand dry weather will tend to check external development and only internal sclerotia may be found. The outer cortical tissues will be killed and discoloration will be prominent on the stem but it will not fall over. Nor may wilting occur but in all cases there will be a yellowing of the leaves.

Lachaine informs me that the symptoms were first noticed in New Brunswick on August 24th, 1921, at a point about half an inch above ground on the stems. A blackish zone extended from this point upward for 3 to 5 inches giving somewhat the appearance of "black-leg." By rubbing, the cortical tissues were easily removed and on September 16th (3 weeks later) the outer necrotic tissues were dried out while the leaves were yellowed. Above and below the necrotic area the stem tissues were still green. On splitting open the affected stems abundant sclerotia were found in the place of the pith.

Fig. 11. — Sclerotical disease of potato. Stems opened to expose sclerotia. Cortical tissues disintegrated.

Life History of the Organism.

Sclerotia remain dormant in the soil until early summer when they may germinate giving rise to apothecia bearing ascospores. The ascopores are discharged and infect the older leaves of the stem in the lowest axils.

The sclerotia may also live over winter in the soil and germinate by mycelium which can infect the plants.

In England and Ireland the organism is known as *Sclerotinia sclerotiorum* but for the sclerotinia found by Lachaine in New Brunswick no definite name can yet be given although it appears to be *S. libertiana*.

Control.

The only satisfactory means of control are crop rotation so that susceptible plants are not available to the fungus and careful removal and destruction of diseased plant parts.

In England, Cotton finds that late planting has proved successful since fewer old leaves are available at the time of spore discharge.

Group 6.
Disease Caused by a Basidiomycete.
Dry Stem-Rot and Black Scurf

This disease is known under a variety of common names of which the chief are:—dry stem-rot, black scurf, black scab, russet scab, Rhizoctonia disease, little potato, aerial potato, rosette, black speck scab and collar fungus.

The first description of Rhizoctonia was given by Duhamel in 1728 as causing a disease of saffron in France. De Candolle in 1815 gave the fungus the name *Rhizoctonia* when he discovered a similar disease on lucerne. In 1851 the Tulasne brothers classified all the then known rhizoctonias as *R. violacea* but Kuhn in 1858 described a species on potato which he named *R. solani*. Webber (1890) first reported the fungus in America and in 1901 Duggar and Stewart (Bull. 186, N.Y.) gave a list of hosts attacked by Rhizoctonia. It is now known to occur generally in the United States and Canada and is reported from the West Indies, India, Australia and South America. The perfect stage was found by Rolfs in 1903 on potato stems and described as *Corticium vagum B. & C. var solani* by Burt.

Other Hosts.

The complete list of other hosts would be too long to include here but mention may be made of tomato, bean, lettuce, carrot, cabbage, pea, pumpkin, beet, carnation and pansy.

Symptoms.

These vary considerably with climatic conditions, age of the plant at infection, and the soil type. The sclerotial stage is very common on tubers where many black sclerotia of varying shape and size (but usually small) are found on the surface. They do not cause any apparent injury since they are superficial. Frequently, however, the skin is more or less cracked and russetted and a still more advanced stage may give rise to scabbing. In this condition drying out in storage or the entry of secondary organisms is facilitated.

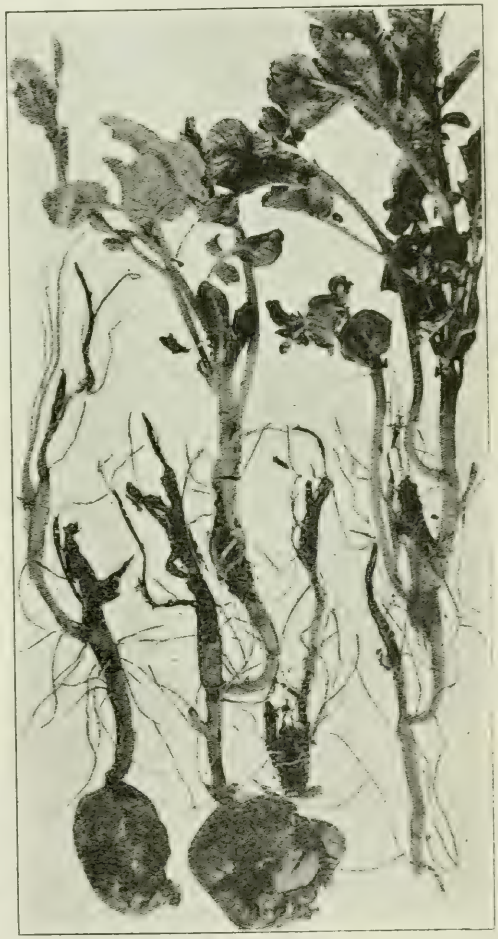

Fig. 12. — Dry stem-rot of potato. Note that lesions occur about at ground level and that the plant may branch out again from below. (After Bull. 85, Mich.)

If the soil is wet or poorly drained and the temperature high severe infection may completely cut off the young shoots before they appear above ground and this in some measure accounts for misses in the field. Sometimes side branches may grow up from below the lesion on dead haulms (Fig. 12) but such branches are weak and spindling, with yellowish leaves. Older plants severely attacked just below ground wilt and die off rapidly. Slight attacks will produce lesions on the stem tending to girdle it and in this case the tops are more or less dwarfed and yellowed. As the fungus gradually encircles the stem and penetrates the tissues water supply is cut off increasingly so that there is a shortening of upper internodes and dwarfing of leaves which gives rise to "rosette top." At the same time the leaves may be slightly wilted and yellowish to reddish green in color and curled. This curling is easily distinguished from the crisp condition in true Leafroll.

When the stem is attacked at the time of early tuber formation so that ample food is being elaborated the girdling of the stem cuts off the translocation of food to the stolons. This disturbance in direction of translocation causes the development of aerial tubers in the axils of leaves. I found many such cases in France during the war and in all cases where aerial tubers were formed there was a closely matted weft of mycelial growth around the stem for about two and a half inches above ground level. That the formation of aerial tubers is not due to root injury but changed translocation of elaborated food can be shown by cutting away carefully the developing stolons around the base of the stem when aerial tubers begin to develop.

On the other hand, if root infection occurs the metabolism of the plant as a whole is affected, the plant is definitely dwarfed and the leaves cannot function to a normal extent so that the potato tubers formed, if any, are small giving the condition known as "little potato."

Life History of the Organism.

Usually the mycelium does not give rise to the sporiferous stage but late in the season forms the small compact blackish sclerotia on the surface of the tubers. If the sporiferous stage is developed it occurs on the weft of mycelium around the base of the stem just above ground. Here the spores are borne on basidia, four spores, measuring 6-8 by 9-14 microns, each on a short sterigma for each basidium. They germinate and cause new infections in the field. The mycelium can grow through or over the soil and in one case north of Arras, France, the writer found that the mycelium grew during two months of a cool, moist summer ten yards along a row from the originally infected potato. Cultivation between the rows prevented its lateral spread.

Control.

Since *Rhizoctonia* prefers heavy, moist soils, drainage and the avoidance of heavy soils difficult to drain is important. If the soil is heavily infected it is inadvisable to plant potatoes. With ordinary soils seed tuber disinfection should be practised. In this connection Howitt at Guelph is doing some interesting work on control by corrosive sublimate. His work for 1920 shows that treating tubers with sclerotia on them for 2 hours in corrosive sublimate 1 in 500 gave perfect control, while treatment for 2 hours in a solution 1 in 1,000 reduced disfigured tubers to 14 per cent. The experiments are still in progress.

Erratum.

In the last issue pp. 203, col. 1, line 40, read "in 1909" instead of "in 1919."—B. T. D.

Book Reviews

Efficient Marketing for Agriculture, by Theodore Macklin. (Macmillan Publishing Company, Toronto, $3.50.)

The modern farmer, even of the progressive type, is inclined to give too little consideration to the economic principles upon which the business of farming is based. In many instances the care given to the problems of production is not coupled with equal care in the distribution and sale of farm products. Unsatisfactory prices are attributed to poor market conditions, falling demand, and many other factors, when the real blame could often be placed directly upon poor grading, improper distribution, lack of adequate storage facilities, etc. If the producers of agricultural products — the farmers —

would study the economic principles of marketing and apply them to their particular conditions, they would realize the importance of efficient handling and would learn the cause of many of their former losses.

This volume by Theodore Macklin, Professor of Agricultural Economics in the University of Wisconsin, is a remarkably complete study of the wide problem of marketing, as applied to agriculture. In the introductory chapter an interesting comparison is made between the simplicity of the methods involved in pioneer production and consumption, and the complications of modern commercial agriculture with its highly specialized productive methods and diversified consumption. The following chapters deal, in perfect sequence, with the economic basis of marketing, assembling, grading, packing, processing, transporting, storing and distribution of farm products. There are also chapters on co-operative marketing, essentials of success, marketing methods, marketing agencies, the market and price making, weaknesses in present marketing system and organization in marketing.

An interesting feature of the book is the selected list of readings given at the close of each chapter, so that anyone may secure further data upon particular phases of the problem. At a time when there is too little available material upon this complex and highly interesting subject, this volume will be welcomed by all who are interested in agricultural economics.

The book contains fifty-three illustrations, thirty-nine tables, nineteen chapters and 418 pages.

Rural Organization, by Walter Burr. (Macmillan Publishing Company, Toronto. $2.60).

The drawing power of urban centres and its effect upon rural communities, has been a matter for public discussion and open debate for many years. The difficulty of keeping the younger generation upon the land was constantly facing the older folks; try as they would to paint a picture, for the boys, of future contentment and happiness on the farm, they found that the city painted a still finer picture, and away went the boys. This condition was a common one in many districts a few years ago, but it is a condition that, in Canada at least, is slowly but surely being removed.

We do not find many neglected farms; we find that the younger generation are staying on the farm, and we find contentment on the farm. Why? Partly because of better means of transportation (the automobile particularly) which brings neighbours nearer together, partly because of better roads, partly because of the rural telephone and rural mail delivery, partly because of better sanitary conditions, and partly because of a greater community spirit — that happy idea of bringing people together for purposes of entertainment as well as for a consideration of their own problems, and of organized effort for their solution.

Much of this change has been the result of rural organization and we can credit rural organization as being the solution, in a large measure, of one of the most serious difficulties facing our countryside a few years ago. Rural organization should be a subject of special interest to all students of agriculture, whether they are interested especially in sociology or not.

This volume by Walter Burr of the Kansas State Agricultural College is particularly timely, is written by a man who has had wide experience in the subject and treats the question from many angles. The author says, in his preface — "In this treatise the attempt is made to present the work in terms of *action* rather than of theoretical plans; to classify such action in terms of definite *functions;* to interpret all in terms of the *local community* and for the benefit of the local leader: and to keep the entire matter in simple and practical form."

The volume is divided into three main parts: General Principles, Organizations and Institutions; Community Economic Functions; Community Social Functions. Every chapter has its own argument to present and each chapter closes with a list of questions for study and a list of research problems for the local community. 13 chapters, 250 pages.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

CONVENTION NOTES.

The second annual Convention of the Society is an event in which every member should take a personal interest and to which he should lend every possible assistance. Preliminary plans are now being made and suggestions will be greatly appreciated. Probably every member knows some subject which might profitably be brought up for discussion, some resolution which he would like to have drafted and adopted or some matter affecting the business operations of the Society which should be considered. Now is the time to submit these suggestions so that a place may be found for them on the final programme. There are so many details to be arranged in connection with the plans for the Convention that prompt and early consideration is essential.

THEREFORE

If you have definitely decided to attend the Convention notify the General Secretary *now* and state whether you desire hotel accomodation.

If you know some agricultural problem that should be discussed, state what it is and name someone to whom you think the subject might be assigned.

If there are matters pertaining to the work of the Society, any changes in the Constitution and by-laws, or any modifications of our operating policies, that might well be considered at the Convention, send in you opinions *now*.

The fullest possible co-operation and support of the Dominion Department of Agriculture has been assured. Hon. W. R. Motherwell has consented to act as Patron and is almost certain to be present.

Hon. J. E. Caron, Minister of Agriculture for Quebec, has also expressed himself as being in fullest sympathy with the Society, and wishes the Convention to be entirely successful.

A preliminary meeting at which the Convention programme will be considered, is being held at Ottawa about March 8th.

All meetings, luncheons, banquets, etc., will be held at the Place Viger Hotel, fifteen minutes from the Grand Trunk and C. P. R. Stations. Unfortunately, on account of the demand for hotel accomodation in Montreal, all reservations cannot be made at that hotel. Rooms will therefore be also reserved at the Windsor and at the Queen's.

APPLICATION FOR MEMBERSHIP

S. J. Chagnon (Iowa, 1921, B. Sc.) Exp. Farm, Ottawa, Ontario.

F. C. Hitchcock (Manitoba, 1916, B. S. A.) Jessie Block, Winnipeg, Man.

H. D. Leppan (Toronto, 1914, B.S.A.) Transvaal University College, Pretoria, S.A.

Theodore Parker, London, England.

J. E. McIntyre, (Toronto, 1921, B.S.A.) Bathurst, N.B.

R. I. Donaldson, S.S.B., St. John, N. B. (Associate).

A. J. Buckland, (McGill, 1921, B.S.A.) Knowlton, P.Q.

W. Downes, Dept. of Agriculture, Victoria, B.C.

A. M. McDermott (Toronto, 1916, B.S. A.) New Westminster, B.C.

Charles E. Hope, Langley Fort, B.C. (Associate Member).

W. R. Motherwell, Minister of Agriculture, Ottawa.

ERRATA

In the January issue the address of J. H. Hare should have been given as 1159 — 71st St., Edmonton. He graduated from the O.A.C. in 1908 and is now employed by the Alberta Department of Agriculture.

W. H. Fairfield is a graduate of the

Colorado Agricultural College (1894) and not of Toronto.

The address of A. W. Peterson should be Dominion Live Stock Branch, Charlottetown, instead of Experimental Farm.

NOTES.

Dr. M. O. Malte, formerly Dominion Agrostologist at the Central Experimental Farm, has been appointed Chief Botanist of the National Herbarium, Department of Mines, Ottawa.

Dr. Charles E. Saunders, Dominion Cerealist, has tendered his resignation, to take effect this coming spring. He has occupied the position since 1903.

W. Betts (Manitoba, 1915) formerly with the Soldiers' Settlement Board at Calgary, is now farming at Sherness, Alberta.

W. R. Reek (O.A.C. '10), Assistant Live Stock Commissioner at Ottawa, has been appointed Director of the new Ontario Government farm at Ridgetown, Ont.

Wm. Strong (O.A.C. '16) has resigned his position at the Ontario Hospital, Whitby, Ont., and is now Manager of the National Farm, Point Fortune, P.Q. (Henry Miles, Prop.)

F. L. Goodman (O.A.C. '15) is resigning from his position with the B. C. Department of Agriculture and returning to his farm at Osoyoos, B.C.

L. Amos (O.A.C. '16) has been transferred by the Soldiers' Settlement Board from Wetaskiwin, Alberta, to Lloydminster, Alberta.

J. E. Thiffault (Montreal '21) is now assistant to A. Laflamme (Laval '18) at Beauceville West, Beauce County, P.Q.

E. H. Strickland (Harvard '12) who has been with the Dominion Entomological Branch for several years at Lethbridge and at Ottawa, has resigned. For the past two months he has been taking special studies at Amherst, Mass., and will assume his new duties as Professor of Entomology with the University of Alberta early in March. This is a new position at this University.

George E. Sanders (O.A.C. '07) Entomologist in charge of Insecticide Investigations under the Dominion Department of Agriculture has resigned to accept the position of Entomologist with the Dosch Chemical Company, Louisville, Ky. We have just received a very interesting letter from George, and are thankful to report that his stay in the United States promises to be a short one. He expects to return to Canada in September. Further announcement later.

British Columbia Branch.

A business meeting of the members resident at or near Vancouver was held at "Braemar" on Friday, February 17th. Among the matters introduced for discussion were (1) the magazine, (2) the local branch constitution, (3) programme for a Provincial Convention, (4) the advisability of holding local meetings in different parts of the Province.

The detailed report of the meeting has not yet been received.

This Branch has been a particularly active and enthusiastic one and its membership list has increased steadily. It now has seventy members.

New Brunswick Branch.

This Branch held its annual meeting at Moncton on January 18th. The result of the election of officers is indicated on the page of this issue which shows the provincial and local organization of the Society.

The discussions at this meeting indicated the increasing confidence of the members in the value and future influence of the Society and of its official organ. The importance of holding an annual Convention was particularly emphasized.

Eastern Ontario Branch.

Monthly meetings have been held throughout the winter and these will continue until May. Addresses have been delivered by Dr. J. H. Grisdale, Dr. J. G. Rutherford, E. S. Archibald and John Barnett (Chairman of the Soldiers' Settlement Board). It is expected that the Hon. W. R. Motherwell will address the February meeting, which is to be held the latter part of the month.

Un Rayon de Lumière sur le Fromage Cheddar Canadien

Par le Dr. A.-T. Charron, M.A.

Directeur de l'Ecole de Laiterie de la Province de Québec.

Les statistiques officielles démontrent que l'industrie laitière est, dans le Canada, l'industrie agricole qui occupe le premier rang. La valeur totale des produits laitiers obtenus dans le Dominion s'est élevée à environ $126,000,000, dont 75 pour cent sont au crédit des deux provinces les plus populeuses, c'est-à-dire, Ontario et Québec. L'industrie laitière est la principale industrie de ces deux provinces et on peut lui attribuer en grande partie le degré remarquable de prospérité qu'elles ont atteint. Ontario est reconnu comme étant la région où il se produit le plus de fromage, tandis que Québec remporte la palme pour la production du beurre. La première, toutefois, détient le second rang pour la production du beurre et celle-ci occupe une position semblable pour la production du fromage. En 1920, la province de Québec a produit pour au-delà de $23,-500,000 de beurre et pour tout près de $13,500,000 de fromage et dans l'Ontario cette production a été de $20,000,000 pour le beurre et de $24,500,000 pour le fromage. A elles seules, ces deux provinces ont produit 70 pour cent du montant total de beurre et 97 pour cent du montant total de fromage fabriqué dans toute la puissance du Canada. Une grande partie de ces produits laitiers sont exportés sur les marchés d'Europe et une vive concurrence existe entre l'Ontario et le Québec dans le but d'acquérir la confiance des importateurs. C'est ainsi qu'une émulation profitable est née qui a pour tendance d'améliorer la qualité des produits. La classification qui a été adoptée durant ces dernières années par plusieurs exportateurs du Canada a révélé le fait que les deux provinces se trouvent sur un pied d'égalité dans les marchés mondiaux pour leur fromage sous le rapport de la saveur et de l'excellence de la qualité. Une entente spéciale ayant été conclue par la Société Coopérative Centrale de Québec avec une grande maison d'exportation anglaise, pour l'exportation directe du fromage de Québec sur le marché anglais, nous avons cru qu'il serait intéressant de faire une étude spéciale d'échantillons bien représentatifs du fromage provenant de chacune de ces deux provinces. Comme il avait été démontré par des rapports d'importateurs anglais que le fromage de Québec et celui de l'Ontario sont de qualité égale, sous le rapport de la saveur, de la texture et de la toilette, nous avons limité notre travail d'investigation au côté chimique de la question. En tout, 25 échantillons furent prélevés dans les entrepôts frigorifiques de Montréal, dont 16 avaient été fabriqués dans des fromageries situées à divers points assez éloignés les uns des autres pour représenter parfaitement la production générale de cette province et 9 échantillons furent prélevés parmi les fromages expédiés de deux des meilleurs districts de la province de l'Ontario, à savoir, Belleville et Brockville. Ces échantillons ont été analysés avec soin, et les résultats sont inscrits aux tableaux qui suivent.

Humidité.—La quantité d'eau contenue dans un fromage exerce une influence considérable sous le rapport de sa valeur nutritive, non pas parce que l'eau possède une valeur nutritive quelconque, mais bien parce qu'un fromage qui en contient une forte proportion est relativement moins riche. La moyenne d'humidité contenue dans les fromages qui font l'objet de cette étude indique que ceux de provenance ontarienne étaient plus humides que ceux de Québec. Sous ce rapport, par conséquent, en nous basant sur les résultats obtenus par l'analyse des échantillons de la série en question, les fromages de Québec semblent avoir une valeur alimentaire plus grande que ceux de l'Ontario.

Matière grasse.—La matière grasse est, dans un fromage, l'élément nutritif qui possède la plus grande valeur alimentaire. Dans la série des échantillons des fromages de Québec, la plus faible teneur en matière grasse se trouve dans l'échantillon provenant de St-Gédéon, Lac St-Jean. Ce fromage en contient 35.75 pour cent et l'échantillon le plus riche sous ce rapport provient de St-Donat, comté de Rimouski, et accuse une teneur de 39.00 pour cent.

FROMAGES D'ONTARIO.

Echantillons prélevés le 17 septembre, 1920.

No du Laboratoire	Désignation de l'échantillon.	Humidité	Résultats analytiques. Sur la substance totale: Matière grasse	Caséine	Indéterminé (cendres, sucre, etc.	Sur la matière sèche: Matière grasse	Caséine
2337	1 Belleville	37.18	36.75	25.32	.75	58.51	40.30
2338	2 Belleville	36.55	35.75	25.87	1.82	56.34	40.77
2339	3 Belleville	35.39	36.00	26.48	2.13	55.72	40.98
2340	4 Napanee	34.21	36.00	27.21	2.56	54.72	41.21
2341	5 Belleville	36.73	35.50	25.52	2.25	56.11	40.33
2342	6 Brockville	35.45	37.00	25.81	1.74	57.32	39.98
2343	7 Brockville	35.61	37.00	25.30	2.19	57.46	39.29
2344	8 Brockville	35.50	37.00	24.82	2.68	57.36	38.48
2345	8 Brockville	35.61	36.50	26.32	1.51	56.67	40.87
	Moyennes	35.80	36.17	25.87	2.16	56.69	40.25

FROMAGES DE QUEBEC.

Echantillons prélevés le 17 septembre 1920.

No. du laboratoire	Désignation de l'échantillon	Résultats analytiques. Sur la matière totale: Humidité	Matière grasse	Caséine	Indéterminé: cendres, sucre, etc.	Sur la matière sèche: Matière grasse	Caséine
2320	C 3. Baie St-Paul, Charlevoix	32.59	38.75	24.91	3.75	57.48	36.95
2321	C 4 St-Valérien, Rimouski	33.78	38.25	24.53	3.44	57.76	37.03
2322	C 5. Bic, Rimouski	34.85	37.25	26.53	1.39	57.15	40.71
2323	C 6. Bic, Rimouski	35.00	38.00	23.03	3.97	58.32	35.35
2324	C 13. St-Gédéon, Lac St-Jean	35.31	35.75	26.73	2.21	55.28	41.32
2325	C 32. St-Félicien, Lac St-Jean	35.20	35.25	24.31	3.24	57.48	37.51
2326	C 38. Métabetchouan, Lac St-Jean .	33.97	35.75	26.37	3.91	54.12	39.93
2327	C 55. Grande Baie, Chicoutimi	34.78	37.00	24.46	3.76	56.73	37.50
2328	C 56. Bagotville, Chicoutimi	36.36	36.00	25.84	2.80	56.57	40.60
2329	C 385. St-Adolphe, Champlain	33.75	37.75	25.07	3.43	56.98	37.69
2330	C 741. St-Amédée, Labelle	33.31	37.75	25.40	3.54	56.61	38.10
2331	A. D. 20. Rimouski	34.33	36.50	25.96	3.21	54.75	38.93
2332	D 71 St-Donat, Rimouski	32.13	39.00	25.94	2.93	58.93	38.22
2333	P 553. St-Prosper, Champlain	37.28	37.75	24.50	.47	60.19	39.07
2334	P 558 Chartierville, Frontenac	35.04	38.25	25.25	1.46	58.88	40.11
2335	P 814 Jonquières, Chicoutimi	35.00	37.00	26.06	1.94	5709	40.21
	Moyennes	34.54	37.38	25.30	2.78	57.09	38.70

Dans la série des fromages d'Ontario, la plus forte teneur en matière grasse se trouve dans les échantillons Nos 6, 7 et 8 du district de Brockville, lesquels accusèrent à l'analyse une teneur de 37.00 %, tandis que celui qui est le moins riche sous ce rapport en contient 35.50 pour cent. Ces chiffres indiquent que tous ces échantillons ont été fabriqués avec du lait entier. La raison pour laquelle les fromages de la province de Québec sont plus riches, en matière grasse, que ceux de l'Ontario semble être que le lait employé pour la fabrication du fromage de Québec est plus riche que celui employé dans la province soeur. La différence de la quantité de matière grasse, entre les fromages québecois et ceux de l'Ontario, est en moyenne de 1.21 pour cent. en faveur de ceux produits dans la province de Québec.

Caséine.—La quantité de caséine contenu dans ces fromages a été établie par la détermination exacte de leur teneur en azote et par le calcul de la caséine, en multi-

pliant l'azote par le facteur adopté par l'Association Américaine des Chimistes Agricoles. La moyenne de la teneur en caséine des échantillons provenant de la province de Québec est de 25.30 pour cent, tandis que celle des échantillons provenant de l'Ontario est de 25.87 pour cent; une légère différence de .57 pour cent. en faveur des échantillons de l'Ontario.

Valeur nutritive relative des fromages des deux provinces, telle que révélée par les échantillons analysés.

Lorsqu'il s'agit d'estimer la valeur alimentaire du fromage, seules les quantités de matière grasse et de caséine sont prises en considération. Les petites quantités des autres substances, telles que le sucre et les matières minérales, peuvent être considérées comme négligeables.

Afin de réduire à un étalon commun la valeur des divers éléments nutritifs, les chimistes ont adopté comme base de calcul la "Calorie". Le terme "Calorie" indique le montant de chaleur dégagée par la combustion de 1 gramme de la matière alimentaire dont on veut estimer la valeur nutritive. La caséine et le gras diffèrent considérablement sous le rapport de leur puissance calorifique. Un gramme de caséine a une valeur calorifique de 4.1 tandis que un gramme de matière grasse en possède une de 9.3.

En nous basant sur la composition moyenne obtenue par l'analyse des échantillons prélevés à Montréal, nous estimons que 100 grammes du fromage de Québec donnent 451.3 calories, soit 2047.4 Calories par livre de fromage. Pour le fromage de l'Ontario le nombre de Calories est de 442.4 pour 100 grammes, soit 2006.9 par livre de fromage—une différence en faveur du fromage de Québec de 40.5 Calories par livre ou de 4050 par 100 livres. En nous basant sur ces chiffres, qui indiquent la valeur nutritive relative des fromages provenant de ces deux provinces, nous trouvons que 100 *lbs* de fromage de Québec valant 102 *lbs* de celui de l'Ontario. Ceci est pour le fromage humide, tel que vendu sur le marché.

Si nous faisons les mêmes calculs pour les éléments nutritifs, matière grasse et caséine, rapportés à la matière sèche, nous trouvons que chaque livre de matière sèche du fromage de Québec a une valeur de 3173.3 Calories tandis que la même quantité de matière sèche du fromage de l'Ontario n'a qu'une valeur de 3094.6 Calories. Par conséquent, 100 *lbs de matière sèche du fromage de Québec* équivalent à 102.5 *de celui de l'Ontario,* sous le rapport de la valeur nutritive.

Tel est le rayon de lumière projeté sur cet aspect du fromage Cheddar canadien pour ce travail minutieux de recherche. La saveur, l'apparence et la texture ne doivent pas être négligées. Tout ce qui attire l'oeil et plaît au palais est de nature à aider la digestion, mais les propriétés nutritives ne doivent pas être négligées. Les éléments nutritifs sont de toute première importance pour l'élaboration des tissus et la réparation de l'usure qui se produit dans l'économie humaine. Lorsqu'il s'agit de choisir une nourriture d'une importance aussi considérable que le fromage, la valeur nutritive doit recevoir sa juste part de considération, spécialement lorsque le choix doit se faire entre deux marques reconnues égales sous tous les autres rapports.

La Pasteurisation

Par J.-E. Theriault,

Professeur de Bactériologie, à l'Ecole de Laiterie, St-Hyacinthe, P.Q.

I.—HISTOIRE

Quand nos yeux sont frappés par la beauté d'une invention nouvelle, quand l'utilité de cette invention nous fait jeter le cri d'admiration à la mémoire du savant inventeur qui a su concrétiser ses idées dans une machine ou un composé quelconque, nous ne nous doutons pas toujours que ce n'est pas un seul homme que nous devrions louer, mais plusieurs intelligences, plusieurs cerveaux, souvent même le genre humain tout entier.

La pasteurisation du lait, comme toute invention, ou toute découverte n'est pas l'oeuvre d'un seul. Dès l'année 1765, en effet, nous voyons Spallanzani faire bouillir de l'extrait de viande dans un flacon hermétiquement fermé et constater que ce

bouillon se conserve indéfiniment. Scheele en 1782 applique le même procédé au vinaigre et prolonge ainsi sa durée de conservation.

Puis Appert en 1804 découvre les conserves alimentaires qu'il explique dans son traité: "L'art de conserver les substances végétales et animales", paru en 1811.

D'autres encore en Angleterre et aux Etats-Unis continuèrent de faire de nombreux essais tendant tous à conserver les substances périssables.

Mais, enfin, Pasteur parut. Prenant à son compte les travaux de ses prédécesseurs, y mettant le sceau de son génie scientifique, il en est arrivé à établir des principes dont les applications pratiques ont rendu des services incalculables à l'humanité.

Le principe du savant fut celui-ci: "Il existe des causes qui amènent les changements des substances animales et végétales, ces causes ont: les microorganismes, les germes. Faisons disparaître ces êtres vivants, destructeurs de la matière, et cette dernière se conservera indéfiniment.

De 1860 à 64, il ne cesse avec ses travaux sur les maladies des vins de prouver la vérité de ses avances, en montrant que du vin chauffé à 122 et 140 deg. F., ne s'altérait plus par la suite. Du vin, on a transporté le procédé aux autres substances comestibles et cette application de la chaleur pour la conservation des aliments a reçu le nom de pasteurisation en l'honneur de son inventeur.

Jusque-là, cependant, on n'avait pas encore osé pasteuriser le lait bien que la stérilisation eut été quelquefois essayée. En 1886, Soxlet fut le premier à proposer la pasteurisation du lait pour l'alimentation des enfants. Mais, pendant plusieurs années, le progrès a été lent dans l'application pratique de cette proposition de Soxlet. L'éducation du public n'était pas faite, les appareils rudimentaires, enfin, beaucoup de difficultés se présentaient qui rendaient la marche de cette découverte pénible et lente.

Les Danois, en 1890, furent les premiers à fabriquer le beurre avec de la crème pasteurisée, additionnée d'un ferment qui, d'après Storch, donnait au beurre une bonne saveur.

Enfin, en 1889, à New-York s'ouvrait le premier centre de distribution de lait pasteurisé. Koplik, le fondateur de cette invention eut à livrer une lutte acharnée contre les préjugés populaires et la haute finance, mais sa cause devait triompher et aujourd'hui la presque totalité de la population de la métropole américaine consomme du lait pasteurisé et s'en trouve bien. C'est donc dire que le procédé a du bon et que le lait pasteurisé a des avantages, c'est ce que nous allons voir.

2.—AVANTAGES

Pour bien se convaincre des avantages de la pasteurisation, il faut admettre ce principe que le lait contient une foule de germes de toutes sortes, germes inoffensifs comme germes dangereux, et que la chaleur est pour ces germes une cause de destruction. C'est donc dire que si la chaleur tue les causes d'altérations du lait, le lait se conservera beaucoup plus longtemps. Et c'est ce que l'on constate par des expériences nombreuses faites à ce propos. Et ce premier avantage est déjà appréciable à cause de la diminution des pertes qu'il produit. Qu'est-ce, en effet, qui fait sûrir le lait, qui le fait se corrompre? Les bactéries lactiques, d'abord, par la production de l'acide lactique, puis les bactéries putréfiantes. Or, la chaleur détruit la plus grande partie des premières et une grande partie des secondes, et celles qui restent sont malades, affaiblies, donc, ne produisent pas aussi vite cet acide lactique qui produit l'aigreur et la coagulation du lait; ni ces acides butyriques ou autres qui amènent la putréfaction. D'ailleurs, c'est un fait d'expérience si facilement démontrable qu'il n'a pas besoin d'être prouvé par des raisonnements bien longs.

Mais là n'est pas encore le plus grand avantage de la pasteurisation. Le lait bien pasteurisé est en outre un aliment inoffensif même pour l'enfant. Et ceci est encore facile à prouver par le même principe que la chaleur tue les germes du lait, et non seulement ces germes que l'on appelle spécifiques, mais aussi les germes des maladies contagieuses dont les deux principaux ont le Bacille de la Tuberculose et le Bacille du Colon. Et vous me permettrez à ce propos de vous citer les expériences rapportées par un auteur américain, Parker (City Milk Supply p. 276 et 287.)

B. Colon.

L'auteur a étudié l'efficacité de la pasteurisation sur 174 cultures de B. Coli

recrutées dans le lait, les excréments des animaux et des hommes, et le fromage.

A 140 deg. F., 54.59 pour cent des cultures ont été stérilisées.

A 145 deg. F. 6.89 pour cent survivent.

La température de 145 deg. F. pendant 20 minutes semble très critique pour le bacille du colon, puisque à cette température quelques cellules seulement restent vivantes.

Enfin si le lait est pasteurisé à 150 deg. F. au-dessus pendant 30 minutes, les résultats indiquent que aucun bacille ne survit.

Pas besoin d'ajouter de commentaires après une expérience aussi concluante.

Mais pourquoi prendre le B. du Colon? Parce que, tout simplement, le microbe est la cause de presque tous les désordres de l'organisme, en particulier du système digestif, causés par la consommation du lait.

Donc le lait pasteurisé à 150 deg. F. pendant 30 minutes est un lait inoffensif au point de vue de l'estomac et de l'intestin.

B. Tuberculose.

Passons maintenant à un autre individu plus dangereux que celui que nous venons de tuer, le B. de la Tuberculose.

Vous savez que la tuberculose, la peste blanche, comme on l'appelle si justement, règne en maîtresse sur nos troupeaux de bovidés et sur notre pauvre genre humain. Vous savez, d'un autre côté, que l'infection peut passer de l'animal à l'homme et que certainement elle passe de l'animal à l'animal et de l'homme à un autre homme. Si donc la contagion est si facile, un lait tuberculeux ira contaminer un animal consommant cet aliment et même pourra contaminer un humain, ce qui arrive trop fréquemment, vous le savez.

La pasteurisation est-elle un moyen de lutte efficace contre ce microbe néfaste? Avant 1889 on était convaincu qu'il fallait pour détruire le B. Tuberculose une température très élevée 175 à 185 deg. Théobald Smith, cette même année, prouva qu'une température de 140 deg. maintenue pendant 20 minutes détruit le Bacille. Russell, Hastings, Rosenau, confirmèrent les avances de Smith avec leurs expériences. En sorte que d'après Rosenau et plusieurs bactériologistes le B. de la tuberculose perd sa virulence pour les cobayes si le lait est chauffé à 140 deg. pendant 20 minutes ou 150 deg. pendant un temps moins long.

Maladies contagieuses.

Quant aux autres maladies contagieuses qui peuvent être disséminées par le lait, voici les conclusions des expériences conduites par les bactériologistes plus haut cités.

1.—Le B. de la Typhoïde soumis pendant 2 minutes à 140 deg. de chaleur est tué.

2.—Le B. de la Diphtérie meurt s'il est chauffé à 131 deg. F. Quelques individus peuvent survivre à cette température mais à 140 deg. les détruit tous.

3.—Le vibrion du Choléra disparaît également et certainement à 140 deg. F.

4.—Les deux types de dissenterie sont tués à 140 deg. pendant 10 minutes.

5.—Une température de 140 deg. F. maintenue pendant 20 minutes suffit pour annéantir le virus de la fièvre scarlatine, les stroptocoques et les autres organismes de maladies contagieuses.

C'est donc dire que la pasteurisation, même à une température relativement basse est un précieux moyen d'assainir le lait. Et n'est-ce pas que cet avantage est assez considérable pour compenser bien des inconvénients?

Mortalité infantile.

Mais j'irai plus loin et, conclusion du même principle, je dirai que la pasteurisation est une cause de diminution de la mortalité infantile. N'y eut-il, en effet, aucune expérience à ce sujet que cette avance serait déjà prouvé par le fait que la chaleur détruit la presque totalité des germes du lait. Mais nous avons plus et ce sont des expériences absolument probantes.

Sur l'île de Rendall à New-York, on avait un pourcentage de mortalité infantile très élevé bien que les enfants ne fussent nourris que du lait de vaches de l'île, vaches bien sélectionnées et bien nourries sur de gras pâturages. Par l'introduction par un monsieur Nothan Strauss de la pasteurisation du lait, la mortalité infantile diminua considérablement à l'hôpital de l'île, quoiqu'il n'y eut aucun changement dans la diète des enfants et voici les chiffres:

En	Enfants traités	% de mortalité
1895..	1216	42.02
1897..	1181	44.36

Et cela avant l'introduction du procédé.

On commence à pasteuriser le lait en 1898. Cette même année le nombre des enfants traités est de:

1284 et la mortalité est de 18.80%

En 1901	18.09
En 1904	16.52

Après cette expérience, nombre d'hôpitaux et de villes américaines adoptèrent le procédé et aujourd'hui grâce aux perfectionnements apportés au traitement du lait, la mortalité infantile est considérablement diminuée.

Est-ce assez pour démontrer les avantages de la pasteurisation? N'y eut-il en effet, que ce dernier avantage de la diminution de la mortalité infantile, ne serait-ce pas suffisant pour encourager les laitiers, les fabricants ou autres intéressés dans la production et la distribution d'un bon lait, à employer ce procédé prouvé si efficace.

3.—OBJECTIONS

Rien n'empêche cependant que la médaille ait deux côtés. Nous venons d'en voir un, voyons l'autre, c'est-à-dire, les objections que l'on apporte contre le procédé et qui peuvent avoir du bon. Ces objections sont nombreuses. J'essaierai de réfuter les principales.

1.—La pasteurisation produit des changements dans le lait. Mais est-ce que ces changements sont de nature à rendre le lait impropre à la consommation? Je ne le crois pas. L'albumine est insolubilisée en partie, dans la proportion de 05 pour cent. Or quelle est la quantité d'albumine dans le lait? Très faible, n'est-ce pas. Quant aux autres constituents du lait, matière grasse, caséine, sucre et sels minéraux, ce n'est pas une température de 140 ou même 150 deg. Fr. qui peut les affecter. Le goût du lait peut être changé un peu à cause de la transformation du sucre du lait en caramel, mais tant qu'on n'aura pas prouvé que la matière grasse, la caséine et les sels minéraux ont changé, on ne pourra pas dire que la pasteurisation a un bien mauvais effet sur les constituents du lait. Les propriétés digestives également ne sont pas considérablement changées et le lait pasteurisé peut très bien servir à l'alimentation des malades et des enfants. Voilà pour la première objection.

2.—Quelques-uns prétendent que la pasteurisation détruit les vitamines, ces principes de croissance que contiennent les aliments. Mais si un chauffage du lait détruit les vitamines de cet aliment, la cuisson que l'on fait subir à tous les autres est donc un procédé condamnable. D'ailleurs, il n'est pas absolument prouvé que comme la stérilisation, la pasteurisation détruise les vitamines du lait. Aussi, a-t-on vu des examples d'enfants nourris au lait pasteurisé se développer normalement sans être atteints de cette terrible maladie du scorbut due au manque de ces principes actifs. Et dans une autre espèce, les jeunes porcs et les veaux nourris au petit-lait et au lait écrémé pasteurisé ne se développent-ils pas comme les autres? A ceux qui prétendent que le lait pasteurisé est un lait mort, un lait malsain, je répondrai avec Hess qui fit dans une institution de New-York un travail considérable sur cette matière, qui prétend que l'emploi du lait pasteurisé pour les enfants, est un moyen d'empêcher les maladies contagieuses de faire périr l'enfant.

Le lait pasteurisé n'est donc pas un cadavre destiné à porter la mort et la pourriture chez son consommateur, comme on a voulu le faire croire déjà.

3.—L'objection la plus curieuse, pour me servir d'une expression peut-être trop polie, est celle-ci: "Le lait pasteurisé ne se conserve pas aussi longtemps que l'autre, le cru." Comprenez-vous que en enlevant du lait les causes de son altération, les microbes, on diminue ses qualités de conservation. Ce sont les microbes, en effet, qui amènent les changements du lait, coagulation et putréfaction; or en détruisant ces causes, on empêche les effets, c'est simple. Mais voilà, on se figure que parce qu'il a été pasteurisé le lait peut être exposé à toute contamination subséquente et qu'il se conservera également bien. Sans doute, le lait pasteurisé est nettoyé il ne faut pas alors le charger de nouveau de germes qui le feront sûrir, cailler et se corrompre. Ou bien on cite comme exemple d'une mauvaise conservation un lait mal pasteurisé, mis dans des bouteilles mal lavées ou mal fermées et l'on conclut à l'inefficacité du procédé.

Pour ma part, je sais de consommateurs qui conservent pendant une semaine à une température de 50 à 60 deg. F. de la crème pasteurisée et qu'au bout de la semaine la crème est encore parfaitement bonne.

Mais l'objection ne tient pas debout et passons à une autre ordre plus pratique, je dirais, au coût de la pasteurisation.

4.—La pasteurisation coûte cher, énormément cher et lès dépenses qu'elle occasionne ne sont pas compensées par le prix plus élevé du lait vendu.

Encore ici il faut y voir par deux fois, car à première vue, l'installation de machines, la dépense de main-d'oeuvre, de vapeur, donc de combustible peut paraître plus grande qu'elle ne l'est en réalité.

Voici un petit aperçu donné par un auteur américain, Mortenson (Management of dairy plants p. 149 et seq.)

	Cts.
Coût de la vapeur	0.017
Coût du refroidissement	0.021
Travail et appareils	0.040
Total	0.078

Coût de pasteurisation d'une livre de matière grasse.

Bovven, d'un autre côté (Blt 85 U.S. Dept. of Agric. 1914) estime à 0.313 cts le coût de pasteurisation de 1 gallon de lait et à 0.634 cts le coût de pasteurisation de 1 gallon de crème à 30 pour cent de gras.

Comme vous voyez, ça ne coûte pas aussi cher qu'on serait porté à le croire. Sans doute, tant que l'éducation des consommateurs ne sera pas faite, tant que les objections ne seront pas réfutées, la pasteurisation ne sera pas une industrie des plus payantes, mais je sais bien par exemple que là où on consomme des produits laitiers pasteurisés on est prêt à payer plusieurs sous plus cher pour ces produits que pour les autres non pasteurisés.

En somme, il ne faut pas s'effrayer outre mesure et le seul fait que le produit, lait, beurre est plus sain, moins dangereux pour la santé est déjà beaucoup pour encourager les laitiers et les fabricants dans la voie de la pasteurisation bien faite.

Je vous ai résumé en peu de mots les avantages et les inconvénients de la pasteurisation. Reste à voir, maintenant, quelles sont les méthodes de pasteurisation ou si vous le voulez les divers procédés.

Il y en a deux principaux: le continue et l'instantané, le flash process, comme disent les américains, le procédé éclair.

Le premier consiste à chauffer le lait à une température de 140 à 150 deg. F. pendant un temps assez long. Ordinairement une demi-heure ou même une heure, et ce, dans des réservoirs spéciaux. C'est le "holding tank process" suivi à New-York au dépôt de Sheffield Farms. Pour la pasteurisation du lait, ce procédé est sans conteste le meilleur parce qu'il ne donne pas au lait le goût prononcé de cuit et ne change pas notablement les propriétés physiques et chimiques. De plus, comme le dit le professeur Van der Lick, à cette température les bactéries pathogènes sont détruites et il reste juste assez de bactéries lactiques pour empêcher la croissance des autres bactéries liquéfiantes et putréfiantes qui feraient gâter le lait. De même à cette température, l'albumine n'est pas insolubilisée.

Le deuxième procédé consiste à chauffer le lait à une température élevée et à le maintenir pendant très peu de temps à cette température. C'est le procédé suivi et enseigné à l'Ecole de Laiterie où l'on chauffe la crème à 170 deg. F. pendant 10 minutes.

Au point de vue de la fabrication du beurre c'est aussi le meilleur procédé, car ici la température élevée ne peut altérer la matière grasse du beurre ni lui donner un goût persistant de cuit. De plus, on a à cette température un moyen de contrôle, l'épreuve dite de Storch, contrôle que l'on ne peut exercer si le beurre a été pasteurisé à une température plus basse que 165 deg. F. C'est cette dernière raison surtout qui a amené l'Ecole à enseigner ce procédé plutôt que l'autre.

Ce sont deux procédés connus et pratiqués aujourd'hui et ceux qui se servent de l'un ou l'autre sont également dans le vrai.

Comme conclusion de cet entretien, je dirai donc que le lait pasteurisé est un produit sain, inoffensif, pouvait servir à l'alimentation et qu'aujourd'hui, avec les percentages de mortalité infantile très élevés que nous avons, nous devrions généraliser ce procédé, mais bien entendu en voyant à ce qu'il soit pratiqué d'une manière convenable. C'est là toute la question de la distribution d'un bon lait, d'un lait sain.

De même le beurre pasteurisé commandant un prix plus élevé sur le marché, il y a avantage à se servir de là pasteurisation pour envoyer un produit de choix sur nos marchés et ceux du monde.

: : EDITORIAL : :

Ever since there have been agricultural colleges in Canada there has been a strange prejudice, in many farming communities, against the so-called "scientific agriculturist." The same opinion has been held, though perhaps not to so great an extent, by agricultural manufacturers. The result has been that the demand for agricultural graduates has been almost entirely limited to the various departments of agriculture and the agricultural colleges. Comparatively few have entered the commercial field or have returned to the farm. To relieve this situation, which after all is merely the result of an entire misconception, an organization such as the Canadian Society of Technical Agriculturists should devote every possible effort. The opinion that agricultural graduates are mere "swivel-chair farmers" ought to be removed and its removal ought to be a simple matter. Ninety per cent of agricultural graduates were raised on farms and their practical knowledge and experience have been increased by their college training. By developing a greater appreciation, on the part of producers and manufacturers, of the value of these men, a new field will soon be opened for the college graduate, and there are certain signs which indicate that new employing agencies must be found for these men who are being turned out annually by our agricultural colleges. That is one excellent work such a Society can perform for the technical agriculturist.

The C.S.T.A. should certainly protect the profession, or any member of the profession, and, if necessary, should create public opinion in some instances. Examples of obviously unfair and unpopular appointments or dismissals are quite common and it is surely the place of a national organization to register strong protest. That is the sort of protection which the profession needs and which this new Society should be in a position to give. The trained and qualified worker will take a keener interest in a body which takes a strong stand than in one which is luke-warm or neutral and there is every reason why the profession should expect such protection from the C.S.T.A. since the maintenance of high standards in the profession is one of its most important objects, set forth in its Constitution. It should take a personal interest in every agricultural graduate and professional worker, follow their careers and help and protect them whenever possible.

In the matter of agricultural research the Society has a tremendous field for useful service. There never was a time when more perplexing problems offered themselves for solution. More and more the value of research and the need for specially trained men are being felt and appreciated. It is only necessary to draw attention to such a plant disease as wheat rust and such an animal disease as tuberculosis, to indicate the field for advancement in pathology alone. There are scores of such problems facing the industry today. The C.S.T.A. might advantageously select some of the most important of these problems and assign them to qualified workers who would keep in close touch with each other so that there would not be too great overlapping or duplication of effort. The Society should also consider ways and means of encouraging the young and ambitious B.S.A. to take up graduate study, so that the number of available qualified workers may be increased. This might mean the establishment of scholarships, though not necessarily so.

The formulation and recommendation of agricultural policies; and perhaps more particularly of educational policies; is within the scope of the C.S.T.A. This is a somewhat delicate task, because each of many agencies has somewhat fixed policies to which strict adherence is considered necessary. But none of these agencies will deny that there is great need for improvement. The matters of uniform courses at agricultural

colleges, co-operation between provincial and federal departments, the manner of conducting extension work, overlapping in departments, and so on, are all suggestive. Probably conferences and discussion would be necessary before a solution is reached, but surely the various branches of the C.S.T.A. and its annual Convention can facilitate such conferences.

And what a far-reaching service can be given by the official organ of such a Society! It will create and mould public opinion, bind its members together, serve as a connecting link with similar movements throughout the world and give needed publicity to what it is doing. Being the tongue of the Society, it must express opinions and offer suggestions and criticisms. It should also be the recognized medium in Canada for publishing the results of agricultural research, extension, etc., etc. There is sufficient original work being done in Canada to warrant a monthly magazine of high quality, and it is to be hoped that the professional workers will take full advantage of this new publication and make it a creditable one.

By holding an annual Convention, the C.S.T.A. provides an opportunity for the professional workers to meet and discuss their problems together. That alone is worth while. The Convention also enables prominent workers in the United States to meet their fellow-workers in Canada and tell them something of the work being done in our neighbouring country. The problems confronting the different branches of the Society are given an airing. A spirit of enthusiasm is created which has not only a local effect but is carried back to all the provinces and thus stimulates new interest and greater activity. And there are many matters affecting the operating policies of the Society which can be adjusted in no better way than by discussion in Convention.

The criticism that there is no useful work for the C.S.T.A. to do has been made by some professional agriculturists. They are evidently not in very close touch with their own profession or with the problems confronting it. The greatest results will be accompanied — by any organization — only when everyone concerned gets behind it, offers suggestive criticism and expresses his loyalty and firm belief in the possibilities ahead of it. Progress is not made (in the right direction) by indifference or by hostility, unless there are good grounds for both. If an organization such as the C.S.T.A. cannot find a useful service to perform in Canada, when every other profession has found it necessary to organize, it reflects little credit upon the trained agriculturists.

TICK PARALYSIS.

A bulletin recently issued by the Health of Animals Branch of the Dominion Department of Agriculture gives for the benefit of farmers and ranchers information on the different species of ticks that have been found to exist in certain parts of Alberta and British Columbia. From this publication we learn that the female of one kind, known scientifically as *Dermacentor venustus*, may under certain conditions cause paralysis, sometimes followed by the death of the animal. Sheep are the chief sufferers from its attack. In Montana it causes what is known as Rocky Mountain fever or Spotted fever, but there are no records of this fever having occurred in this country. The tick appears as an adult early in the spring and attaches itself to the skin of wild and domesticated animals and man. The female lays about four thousand eggs. After a period of thirty-six days or so, the eggs hatch into minute six-legged larvae or "seed" ticks. These ticks crawl up on to grass or other supports, and when the opportunity offers, attach themselves to small animals such as rabbits, squirrels, ground squirrels, field mice, and other rodents. They progress by stages of development until larger animals become their prey. Mr. E. A. Bruce, the Animal Pathologist, who is the author of the bulletin, gives full particulars of the life history and habits of *D. venustus*, with methods for its destruction and for treatment after attack.

(Publications Branch, Dept. of Agr., Ottawa)

DISEASES OF THE POTATO.

Owing to pressure of regular duties, Professor B. T. Dickson has been unable to prepare his article on the above subject this month. The series will be resumed in the next issue.

Seed Potato Inspection and Certification in British Columbia.

By C. Tice, Potato Specialist Department of Agriculture, Victoria, B.C.

During recent years the potato crop has been receiving greater attention at the hands of specialists than ever before. Low yields due to poor seed have been the chief reason accounting for the interest now being taken. It is recognized by all who have considered the subject closely that seed potatoes should carry as little disease as possible. Unfortunately, the potato is affected by a great variety of diseases.

The discovery of such diseases as leaf roll and mosaic have proven that the yield is considerably reduced wherever they exist. Since these diseases can only be detected in the growing crop it is essential in order to obtain the very best potatoes for seed purposes to inspect the crop during the growing season as well as after harvest.

History of Seed Potato Certification.

Seed potato inspection and certification have been carried on both in Europe and the United States for some years. Records show the system was introduced into Canada in 1915, in the provinces of New Brunswick and Prince Edward Island, by the Division of Botany of the Federal Department of Agriculture. This work has been gradually extended each year with the result that in 1921 a seed potato inspection service had been established in all the provinces of Canada.

The potato growers of the Province of British Columbia first received the benefit of seed potato inspection and certification in the summer of 1921 when the work was introduced by the Provincial Department of Agriculture. The system of inspection which has been adopted here is similar to that being carried on in other parts of Canada and throughout the United States.

Number of Inspections.

The number of inspections made both in the growing crop and after harvest varies in different parts of America. In some places one field and one tuber inspection are made. In other places two field and two tuber inspections are made and in others two field and one tuber inspection are carried on.

In the Province of British Columbia two field and two tuber inspections have been adopted. The reason for making two field inspections is because diseases develop at various times throughout the growing season, and therefore the possibility of overlooking any disease is less likely than where only one field inspection is carried on. Furthermore, it allows the grower, who has a *limited* amount of disease in his crop at the first field inspection to rogue and thereby reduce the percentage of disease.

Crops which are apparently free from disease in the growing season but lack vigour are always rejected for seed purposes.

Two tuber inspections are made because it is a well known fact that if the best results are to be obtained from seed certification work thoroughness is of the greatest importance at all times. The experience of other provinces and states reveals the fact that many difficulties arise where only one tuber inspection is adopted.

The first tuber inspection is made before the crop is graded. The object of this inspection is (1) to ascertain whether the crop is sufficiently free from disease and true to type to warrant the grower grading, or, in other words, to avoid unnecessary labour and expense to the grower and (2) to show the grower how to grade.

The second tuber inspection is made at shipping time to ascertain whether any storage diseases have developed or frost injuries occurred; also to find out if grading regulations have been strictly observed.

Standards for Inspection.

Realizing that it is a practical impossibility to produce large quantities of

seed potatoes absolutely free from disease the following standards have been set for a crop to measure up to at each inspection for 1922. These standards have been drawn up by J. W. Eastham, Provincial Plant Pathologist, and the writer:—

A. Field Inspection.

(a) First inspection (early summer or bloom-time). Foreign (impurities): Not more than 5 per cent allowed. Curly dwarf, Leaf roll, Mosaic: Not more than 5 per cent of the combined diseases allowed.

Wilt: Not more than 3 per cent allowed.

Black leg: Not more than 2 per cent allowed. At this inspection the presence of rhizoctonia and early blight, also the degree of severity of attack by these diseases is noted by the inspector.

(b) Second field inspection (late summer).

Foreign (impurities): Not more than 2 per cent allowed.

Leaf roll, Curly Dwarf, Mosaic: Not more than 2 per cent of the combined diseases allowed.

At this inspection the presence of late blight and rhizoctonia, also the degree of severity of attack by these diseases, is again noted by the inspector.

Rogueing must be carried on throughout the growing season by the grower.

B. Tuber Inspection.

Rhizoctonia: Not more than 10 per cent of *slight* rhizoctonia and not more than 3 per cent of *severe* rhizoctonia allowed and no scurf spot larger than 1-8 inch in diameter.

Occasional spots constitute slight rhizoctonia.

Stem end discolouration: Not more than 3 per cent allowed.

Late blight or dry rots: Not more than 2 per cent allowed.

Powdery scab: No severe powdery scab allowed. Not more than 1 per cent slight powdery scab allowed. Occasional spots constitute slight powdery scab.

Common scab: No severe common scab allowed. Not more than 5 per cent of tubers with slight common scab allowed.

By severe common scab is meant infections (a) covering more than 5 per cent of surface of tuber: (b) taking the form of cavities.

Net necrosis: Not more than 5 per cent allowed.

Internal brown-spot: Not more than 3 per cent allowed.

Silver Scurf: Not more than 5 per cent allowed.

For the combined diseases, late blight or dry rots, stem end discolouration and rhizoctonia (severe) not more than 2 per cent allowed.

For the combined diseases, late blight or dry rots, stem end discolouration, rhizoctonia (severe), net necrosis, internal brown spot, and silver scurf, not more than 5 per cent allowed.

For the combined diseases, late blight or dry rots, stem-end discolouration, rhizoctonia (slight), and common scab (slight), not more than 7 per cent allowed.

For the combined diseases, late blight and dry rots, stem-end rot or discolouration, rhizoctonia (slight), common scab (slight), net encrosis ,internal brown spot and silver scurf, not more than 10 per cent allowed.

Grading and Tagging.

Growers whose crop passes the above inspections are required to grade their seed to conform with desirable commercial grades. No potatoes smaller than 3 ounces or larger than 12 ounces are allowed where one grade of seed is being put up. Where two grades of seed are being made, the one to supply those who require small whole seed for planting, potatoes weighing 2 ounces are allowed in the small whole seed class.

Crops which conform to the above regulations may be sold as certified seed. A tag is issued by the inspector for each sack of potatoes the grower has to dispose of. This tag bears the name and address of grower, variety, size of seed, and date of final inspection. It is attached and sealed to each sack by the inspector at shipping time.

Some Results from Inspections made in 1921.

The following table is a list of the varieties, source of seed, and number of fields inspected in each district in 1921. Also the average percentage of two very important potato diseases, namely, Leaf Roll and Mosaic, together with the average percentage of impurities:—

Dist. No.	No. of fields inspected	Variety	Source of seed.	Av. per cent. Leaf roll	Av. per ct Mosaic (severe)	Av. Per cent impurities.
1	20	Netted Gem	Local selected	.41	....	1.07
1	6	Jersey Royal	"	.31	.50	1.25
2	6	Up-to-date	"	3.83	....	1.00
3	2	Up-to-date	"	2.85	.50	....
4	3	Ormandy	"	.66	.37	....
5	3	Up-to-date	"	1.16	....	....
6	5	Sir W. Raleigh	"	2.89	.25	5.00
7	1	Jones' White	"	.25	2.00	....
8	5	Burbank	"	....	....	.25
9	3	Netted Gem	Certified	....	....	....
9	12	I. Cobbler	"	.25	....	.50
8	8	Up-to-date	Local selected	.48	.25	....

The above table shows that leaf roll and mosaic diseases do exist in British Columbia, but apparently in very limited amounts. The table also brings out the value of certified seed in comparison with selected local seed; disease and impurities being much more prevalent in selected local seed. The reason for this is because olcal seed was selected from the tubers only and certified seed from the growing crop and tubers.

The Value of Seed Potato Certification.

The value of seed potato certification may be summed up in the following points:—

(1) Educational — The advice which the grower receives from the inspector at the time of making the various inspections, whether in the field or after harvest, is of great educational value.

(2) Elimination of the Oriental — In this Province over 60 per cent of the potatoes are grown by Orientals. The Oriental pays little attention to the kind of seed he plants with the result that he produces an inferior product. The market of today requires a high quality product. The farmer who uses good seed will be in a position to supply that market. In the production of certified seed the white man will be in a class by himself.

(3) The greater portion of the seed on the market nowadays is impure and often contains a large percentage of disease. In fact, the public have great difficulty in purchasing reliable seed. The introduction of certified seed potatoes will tend to correct the present conditions.

(4) The careful grower will receive recognition for the extra trouble he has taken in producing seed of high quality by being able to secure a premium for such seed.

(5) Districts which are not suitable for producing seed of high quality, but able to produce good commercial potatoes, will have an opportunity of obtaining reliable seed from time to time.

(6) The use of certified seed should be the means of improving the commercial stock throughout the province. Production of good commercial stock will mean better markets.

(7) Seed potato certification will help to bring about the standardization of varieties, since certain varieties only will be certified in each district taking up the seed certification work.

(8) Seed potato certification will be one method of getting potato growers in the same district working together. Co-operative effort is essential for best results in every line of production. Several potato growers organizations have been formed as a result of the seed certification work in this Province.

(9) On account of the favourable conditions existing in this Province for potato growing it should be possible to build up an export trade in seed potatoes. This year enquiries for certified seed have been received from the United States and prairie provinces of Canada, but unfortunately it has not been possible to meet the demand.

(10) Even if a potato grower does not wish to specialize in the sale of certified seed, the benefit to be derived through an inspection of his fields in order to improve the quality of his own seed is sufficient to make it well worth while.

Soldier Land Settlement as a National Project.

John Barnett, Chairman, Soldier Settlement Board, Ottawa.

Soldier Land Settlement is not, as generally imagined, purely a re-establishment measure. So far as the individual is concerned, it is probably not even primarily re-establishment. It offered — or, at least before the slump in prices, it was thought to offer — substantial benefits to the returned soldier farmer. It undertook to supply for the purchase of the land and equipment, large capital advances to men without financial assets of their own. It provided money at cost, and it undertook to carry all the administrative expenses of land and stock inspection, legal fees and general supervision, without charge to the applicant. No such assistance could have been obtained from any existing land or loan company, or even from any public or semi-public rural credit society.

These benefits were not offered as compensation for military service. They were not even made in recognition of the individual soldier's need of employment. They were due entirely to a national recognition that land settlement was the basis of our future prosperity, and that economically we could not afford to lose from the soil any Canadian soldier who, by experience and desire, was fitted to engage in agriculture. Capital is necessary to undertake farming. It could not be expected that any large number of men, after three or four years service of war at $1.10 a day, would have any appreciable amount of personal capital. If they were to take up farming, the State had to be prepared to finance them. Even so far as the Canadian soldier is concerned, Soldier Settlement is, therefore, essentially land settlement, and a real attempt at agricultural colonization.

The provisions of the Act cover all ex-soldiers of the Imperial Army and of the other Dominions. It is self-evident that this country was under no obligation to provide re-establishment for these men, and that so far as the Imperial settler is concerned, there can be no question of re-establishment.

It is generally conceded that the war demonstrated that in a time of national peril, settlers from alien European countries were not, as a rule, a national asset, but were rather a hindrance to concerted national effort and progress. The war also emphasized the economic advantage of a population closely knit together by language, aims, customs and civilization generally.

The British Army contained more than six and a half millions of the most vigorous, most energetic and most loyal of Britain's young blood. The men were drawn from every industry and calling, and amongst them were more than 350,000 belonging to agriculture, who were and are, by experience and training, well adapted to undertake settlement in Canada. The inducement offered to these men through The Soldier Settlement Act is nothing more or less than a direct attempt at State-aided land settlement, and a new effort in agricultural colonization.

Despite the hardships of the time, very substantial re-establishment benefits have accrued to Canadian veterans through the Soldier Settlement Act, and as a factor in re-establishment, the work done has very great value. A very large majority of our settlers, in spite of the difficulty of getting adequate cash returns for their produce, have at least been provided with food for themselves and their families, a roof over their heads, and an independent source of livelihood, when but for the Soldier Settlement Act, many would today be found in the ranks of the unemployed ex-soldiers who are congesting our urban centres. Nevertheless, considered as a national project, the methods adopted and the results accomplished must be judged on the broad basis of agricultural colonization.

The incidental aspect of re-establishment has created many administrative difficulties which have been accentuated by the popular belief that the primary object underlying the whole effort was re-establishment, and as a consequence the Board has not been able to safeguard its position with all of those means which commercial

and business experience and judgment have found to be necessary. Here again, to consider fairly the methods adopted and the results accomplished, the initial difficulties surrounding the work must not be lost sight of.

The Act provided for advances aggregating as high as $7,500.00 to an ex-soldier who had no personal assets of his own, beyond $500.00 or $600.00. The Board was compelled to pay in all cases at least 90 p.c. of the market value of the land, and in addition, it had to advance on livestock, implements, buildings and building material, 100 p.c. of the value of the property so acquired, and this very largely at a time when such chattels were at the peak of wartime prices. This meant that no margin of security was possible.

It was almost impossible to appraise adequately the moral risk, as we had to go back to the applicant's history as a civilian, prior to the war, and before two, three or four years of military service had changed the whole current of his life.

The Act did not permit any arrangement enabling the Board to create a reserve fund to cover losses and failures, as no advance in the price of land or chattels was permitted, and in addition, all administrative costs had to be carried without charge.

Finally, before the Board had an opportunity to erect even the framework of an organization, it was besieged by thousands of applicants, just demobilized, who demanded instant establishment on the land.

Deprived to a large extent of the safeguards generally available to ordinary businesses, the Board was compelled to adopt new protective measures of its own. It had to recognize that its best security lay in the settler himself, and that having no property margin, it must build up and improve his personal or moral risk. The weak and indifferent settler had to be strengthened, the poor farmer had to be turned into a good one, and the inexperienced farmer into a practical farmer. Only so far as it was possible to do this could losses from failure be prevented and public money adequately preserved.

It was early discovered that it was not sufficient to see that the land purchased had a market value equal to the purchase price. It had to have this, but in addition, it also had to have productive possibilities sufficient to ensure that with reasonable effort and work on the part of the settler, he would eventually be able to make a living and carry his overhead thereon, and latterly every effort has been made to see that the particular parcel of land selected by the individual applicant is, so far as possible, adapted to his peculiar temperament and qualifications.

The same condition was soon ascertained to apply in the purchase of stock and equipment, and generally it was clear from the outset that if permanent settlement was to be obtained and losses of public money avoided, the individual settler had to be planted in the soil and nursed and tended until he took root and became firmly attached thereto.

Millions of dollars have been spent by this country in inducing agricultural immigrants to settle on our lands. Once the immigrant has been placed on the land, little attention has been paid by anyone to his welfare, he has been allowed to live or die, as chance might befall, and no effort has been made to conserve his strength or capital. The work of supervision which has been developed and extended by the Board marks an entirely new effort in colonization and land settlement in Canada. On an average, with every one hundred and twenty settlers established, there has been located a trained Field Advisor and Supervisor. Of the one hundred and eighty men employed in this work, all are, so far as it is possible to observe from their records, practical farmers, and a very large number of them have in addition, been scientifically trained in agriculture in our various agricultural colleges and institutions.

The national results accomplished without as yet any serious loss of public money, and despite all the initial and business handicaps, are due to a very large extent to the ability, knowledge and scientific training of the field men so employed. If out of the 21,000 settlers established by loan, no more than 15,000 eventually stay on the land and make good, starting as they did with no capital behind them except borrowed capital, equipped at the peak of high prices ,and faced, before they had a chance to produce a real crop, with the worst collapse in agricultural

prices that has been seen for many years, this work will afford the greatest testimonial to the practical and economic value of scientific agriculture as a factor in land colonization that this or any other country has ever seen.

This is not the best time to take stock of the results accomplished, but notwithstanding the depression of today, the position of Soldier Land Settlement is not gloomy, but is rather full of promise.

Altogether, by virtue of the provisions of the Soldier Settlement Act, more than 27,000 returned soldiers have been established on the land. Of these, 21,000 have been granted loans, and the balance settled on free land without loan. The numbers given may seem small, especially when contrasted with ordinary immigration figures, but when it is remembered that in the whole of the province of Prince Edward Island, there are considerably less than 15,000 farmers, and in the province of Manitoba not more than 50,000 farmers, their true significance becomes apparent. These 27,000 returned soldiers are heads, or potential heads, of families, and their settlement on the land means the retention in, or addition to, the agricultural industry of this country of from 100,000 to 125,000 souls. If all the men established under the Soldier Settlement Act were concentrated in the Maritime Provinces, they would occupy every farm in the province of Prince Edward Island, and more than half the farms in the province of Nova Scotia.

On this work there has been expended approximately $96,000,000.00 of public money. This includes all advances for loans and all administrative charges of every kind whatsoever, but there has already been returned to the Public Treasury more than $13,000,000.00.

From a business point of view, the test of the work done must be found by scrutinizing (a) the number of settlers who have failed or for other reasons have abandoned their efforts; and (b) the extent to which the settlers on the land are meeting, and are able to meet, their repayments as they fall due.

Of the 21,000 men settled by loan, approximately 10 1-2 p.c. have abandoned their efforts and their land and equipment have been salvaged or are in process of salvage. These figures include deaths, failure from recurrence of war disability, and some cases where the settler has sold at a profit. In 616 cases, complete foreclosure proceedings have been taken, and all land, stock, machinery and equipment have been completely sold out. In these cases there was invested $2,511,000.00 of public money, and the receipts, after the sale of everything salvageable, amount to $2,519,000., or an appreciation of more than $7,000.00. Owing to the decline in the price of livestock, as well as to general depreciation, which is to be found in most salvage cases, large losses have been taken in foreclosure sales of stock and equipment. In some individual cases, losses have also been taken on resales of land, but on the whole, due to the sound principles followed in the purchase of land, sufficient appreciation has accrued to more than cover thus far the losses taken on stock and equipment. If present economic conditions continue, it cannot be expected that so favourable a showing will continue to be made, but it is clear that the failure cases are not going to involve unduly large losses of public money.

Under their contracts, settlers' payments fall due annually in the western provinces on October 1st, and in the eastern provinces on November 1st. Shortly after harvest in the fall of 1920, there was a very sharp decline in the price of wheat and other grain products. At that time some 12,000 soldier settlers had to meet their first large payments under their agreements with the Board. These payments aggregated $2,200,000.00. Over 10,000 of these settlers made their payments in whole or in part, and in addition, a considerable number of other settlers made over-payments or prepayments, with the result that altogether on last year's collections the Board received $2,300,000.

In the province of Ontario, 91.3 p.c. of the soldier settlers met their obligations, and in addition, there was collected in this province alone, more than $200,000.00 in over-payments.

Economic conditions in the last two months of 1920 and the first six months of 1921 were not so serious as those existing at the present time. Nevertheless, the

collection showing made by soldier settlers is most remarkable, and will more than compare favourably with ordinary business institutions, which operate with large property security margins behind them. This year conditions have been much more difficult, but since the first of October in the west and the first of November in the east, nearly $1,500,000.00 has been collected on this year's payments, and money is still coming in at a very fair rate. While a little less than 30 p.c. of the actual money due has been collected, this percentage again compares more than favourably with the results being obtained by rural credit societies, farm implement companies and such like institutions, which have a somewhat similar collection problem to that of the Board.

The real value of Soldier Settlement as a national project is not to be found, however, in the contemplation of those figures and terms by which commercial institutions are judged. The value of the work from a national point of view cannot be computed in terms of dollars and cents, but is, nevertheless, most real and far-reaching in its effects.

More than 600,000 acres of land, hitherto wild and unproductive, have been made ready for cultivation and have produced, or this year will produce, a first crop. This is practically equal to the whole of the cultivated area of the entire province of Prince Edward Island, and from this point of view alone, it may truthfully be said that a new agricultural province has been brought into being by reason of Soldier Land Settlement.

Thus far, from 12,000 to 15,000 of the men established have settled on entirely wild lands. Another 4,000 or 5,000 have settled on farms so inadequately improved that they might for all practical purposes be classed as unimproved lands. The balance, of from 6,000 to 8,000 men, have been settled on more or less well improved properties, replacing thereon the former owners, but even here much national good has resulted, because in the older sections of the country, many of the former owners were, by reason of old age or other causes, unable to carry on farming further, and had it not been for Soldier Land Settlement, much of the land would undoubtedly have gone back to pasture. A real national service has been rendered in preserving intact the existing farm unit and the maintenance thereon of a producing farm family.

With only a very small number actually producing, soldier settlers in 1920 contributed to the national wealth of the country from $15,000,00.00 to $25,000,000.00 worth of farm products, which in the course of the next few years, will be doubled or trebled. Out of their 1920 farm production, from exportable farm products alone, they contributed to the railway freight receipts of this country more than $3,000,000.00. This year, because of the larger number, that contribution will undoubtedly be doubled, as will the value of their farm products.

The Canadian Pacific Railway Company has estimated that the annual value of a new settler to the railways is $730.00. If that be so, the 25,000 soldier settlers still on the land have an actual value to the railways alone of more than $15,000,000. per annum. Their national value is, of course, much larger even than this.

From the work done, and even from the mistakes made, very valuable lessons have been learned, and a great mass of information is stored up in the various offices of the Board, which is of the utmost value in any agricultural colonization or land settlement work which this country may conduct within the next few years.

As stated before, at the present time it takes a very great deal of courage to write of Land Settlement as a national project. Agricultural industry is in a depressed condition. The old line farm loan companies are granting extensions wholesale. Rural credit societies, with ample security margins, and dealing largely with well-established farmers, are being forced to carry large arrears of interest, while the farm implement concerns consider themselves fortunate when their collections reach a 15 p.c. or 20 p.c. level. Grain prices are away down. Cattle were almost unsaleable. Hogs have dropped seriously, and even the old reliable hen and dairy cow have slid dangerously. Nearly everything the farmer has to sell is back to, if not below, pre-war levels. Freight rates are not any more of a consolation than they ever were, and while mar-

keting, operating and living costs have all fallen a little, none are really back to before-the-war figures.

In the economic re-adjustment, the farmer has had his fingers badly pinched. Worst of all, the drop in the prices of agricultural products has been so sudden that the farmer has landed at the bottom with much the same feeling you have when the elevator boy shoots you swiftly from the tenth floor to the basement — stomach upside down, head dizzy, and generally groggy.

The adverse economic conditions which have hit farming generally so heavily might well appear to be almost a calamity to the soldier settler, and a near catastrophe to the whole scheme. The bulk of the men were settled in 1919, or early in 1920. Land had to be purchased when $2.00 wheat miraged the whole landscape. Horses and cattle, seed and feed, and all essentials to start with had to be bought at the then market prices, which, in many cases, were double those of today. No settler had accumulated a money reserve during boom prices. Few had any personal assets, and practically all of them were, and are, operating solely on borrowed, interest-bearing capital.

The pessimist is with us. In these times he is the special, self-appointed friend of the soldier settler. For nearly a year he has been driving it home daily that success is impossible and conditions hopeless, to the soldier settler anyway. Nevertheless, of all our failure cases, less than one-third have arisen during the past trying year. The future is not without promise. Already very large benefits to the nation have accrued, and no substantial losses of public money have been made. The first crash in grain prices was in 1920. A year and a half has passed since then. It is almost a year since the elevator boy slammed his throttle and left the farmer gasping in the basement. Other men and other businesses are following him down—some of them crashing too—and already there are indications that the farmer is beginning to recover.

In any event, Canada still must have more people—and she must have them on the land—if she is to live and thrive and pay her debts, and that is the real justification for Soldier Land Settlement.

SCIENCE & EDUCATION EQUIPMENT

This catalogue, issued by the McKay School Equipment, Ltd., Toronto, had a special mission ahead of it which in a way decided the design it should follow. There had been no catalogue in Canada attempting to cover Science Apparatus in a general and comprehensive way.

There was nothing to cater to the needs of the universities, agricultural colleges and other highly specialized teaching institutions. Any special subjects that were dealt with when put in catalogue form had only reference to the very simplest apparatus and material. This catalogue, "Science and Education" now covers the ordinary needs of practically every type of laboratory in the country including the industrial laboratories. A number of reference and comparison tables at the beginning of the volume make a useful ready reference. The catalogue proper is divided into sections so that each section can be issued separately if necessary, such as Bacteriology, Analysis Apparatus, General Chemistry, Agricultural & allied subjects, Physical Apparatus, Projection Apparatus, Assay and Mining Chemicals, Stains and Reagents. The numbering system is so designed as to take care not only of immediate needs, as manifested in the items actually listed, but leaves room for the probable and possible additions that may be included for a great many years to come. The numbers themselves are arranged so far as possible so that very frequently called for items have an easily remembered number, for instance 1050 commences beakers, 1500 commences combustion apparatus, 1800 commences filter papers, 1900 commences flasks, 2000 funnels and so on. The index forms a cross reference. The chemical list, which is an extensive one, includes formulas. Considerable thought was given to the type selected, the arrangement of illustrations and the paper and press work generally in order to make the book readable and as attractive as such a prosaic piece of work could be expected to be.

Alfalfa Hybridization.

W. Southworth, Manitoba Agricultural College, Winnipeg.

(Paper read before the Western Canadian Society of Agronomy, December, 1921.)

Introduction.—In a former article (4)* dealing with the subject of hybridization of Alfalfa with Black Medick, the author explained the results of investigations which had been conducted in the seasons of 1911, '12, '13. During these years the field work was carried out at the Ontario Agricultural College, Guelph, and a part of the greenhouse work in the plant breeding department at the New York State College of Agriculture, Cornell University.

The investigations were continued at the Ontario Agricultural College until the autumn of 1915; since that time, they have been continued at the Manitoba Agricultural College. Since the season of 1913 considerable work has been done with these hybrids; but new information accumulates very slowly, and it is purposed at a later date to issue a Report of Progress setting forth the outstanding results so far obtained.

The aim of the present paper is to give an explanation of the working methods adopted in these hybridization investigations.

Before launching directly into our subject, it will, perhaps, be advisable to draw attention to, and revise, certain statements made in the previous paper (4) to which reference has been made. The statements referred to are concerned with the natural fertilization of Alfalfa flowers (4; p. 449, col. 2) and are stated thus:—

"From the results of our observations and tests, we may conclude, 'From the structure and mechanism of the Alfalfa flower, it is incapable of self-fertilization if it is not interfered with by external agencies, natural or artificial."

The above statement was made on the result of a two year's test at Guelph. At that station, when flowers were caged so as to prevent access of insects, not a single seed was produced. In subsequent experiments, we have found that when similar tests are conducted in Manitoba quite an appreciable amount of seed is obtained from flowers which have not been selfed artificially nor visited by bees.

The reason for the striking difference between the results at Guelph and Manitoba are doubtless owing to the much dryer atmospheric conditions in Manitoba together with higher temperatures and a greater amount of sunshine in summer than obtains in southern Ontario.

Fig. I. Alfalfa plant in full flower.

Hybridization of Alfalfa.

In conducting any kind of hybridization experiments, it is clearly essential that the worker should first become thorough-

*The numbers in brackets in the text refer to literature cited on the subject,—a list will be found at the end of the paper.

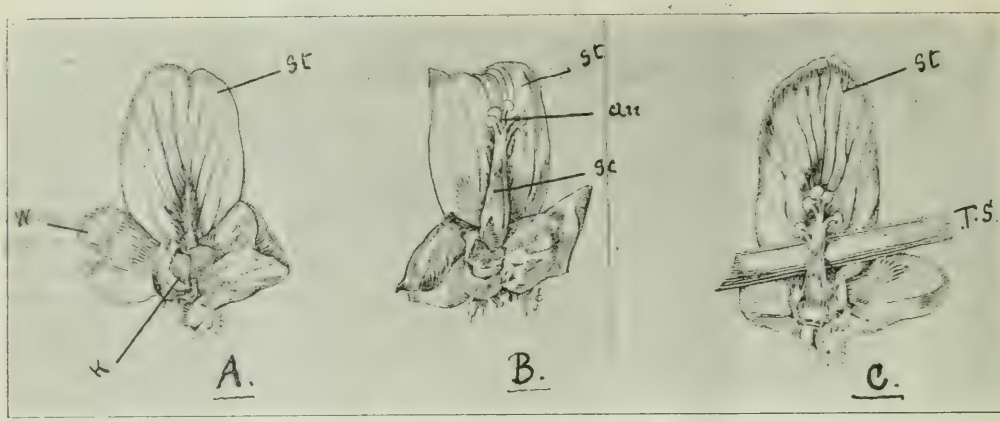

Fig. II. Alfalfa flower: front view, A, B, C.
st: standard; w: wing petal; k: keel; s. c.: staminal column; an: anthers and stigma; T. s.: Timothy stem.

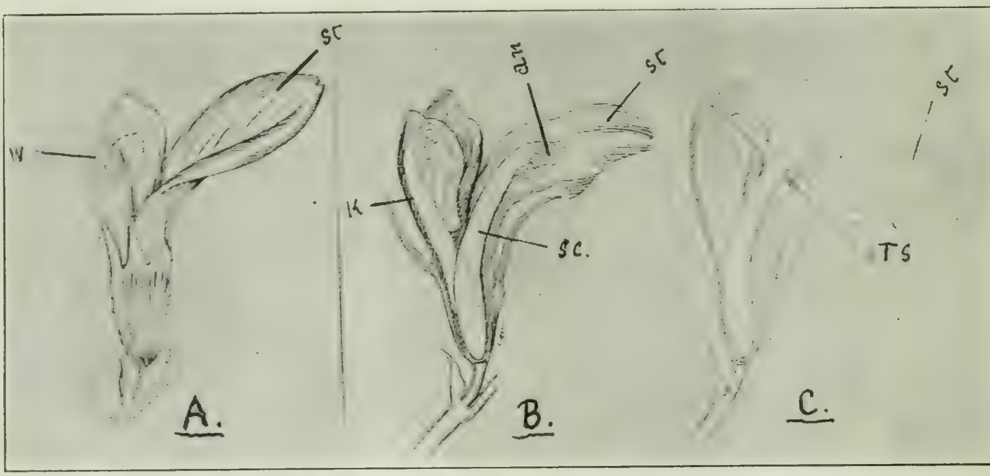

Fig. III. A Alfalfa flower: side view.
B Position of stamens before and after tripping.
C Stamens in position for emasculation.

ly conversant with the general structure and mechanism of the flowers of both parents he wishes to hybridize. This can best be obtained by carefully examining and studying the flowers as a whole; then carefully dissecting and examining each part separately.

Principal Parts of the Alfalfa Flower.

(See Fig. II. Fig. III.)

Calyx.—The calyx is situated at the base of the flower; is greenish in color; and divided up into five pointed sepals.

Corolla.— The corolla arises from the inner portion of the calyx and is made up of five petals.

1. One large and fairly upright petal known as the standard or banner. (St.)

2. Two smaller petals, one on each side of the standard, known as the wings. (W.)

3. Two inferior petals, somewhat loosely held together by the joining of their upper and lower edges, form a closed boat-shaped structure known as the keel. (K.)

Stamens.—There are ten stamens, the filaments of nine being fused together to form a hollow tube-like structure which may be termed the staminal tube. At the upper end of the tube the ends of the filaments are free, the anthers being attached to the free ends. The filament of the tenth stamen is quite detached and free from the other nine and is situated above the staminal tube. (8c.)

Pistil.—The pistil consists of style and stigma and is contained in the staminal tube. The style being nearly equal in length to the tube, the stigma is brought into a position slightly below that of the anthers: this appears to favor the chances of the flower being self-pollinated.

The staminal tube together with the enclosed pistil may be conveniently referred to as the sexual column. This column is completely inclosed in the boat-shaped structure formed by the two keel petals and usually remains imprisoned in the keel until liberated by wild bees or some other suitable external agency. This act of setting free the stamens and pistil is commonly known as tripping the flower.

Natural Tripping of the Alfalfa Flower.

Tripping under natural conditions in the field is usually brought about by wild bees. Bees of the Megachile species seem to be most effective in tripping the flowers. The hairs on the legs and abdomen of these bees seem to be specially designed to catch and to hold the pollen, and these bees are frequently found with the under part of the abdomen and thorax as well as the upper parts of the legs completely loaded up with masses of pollen; thus it will be seen that this species of bee is a very useful agent in the distribution of pollen and in this way natural cross-pollination of the Alfalfa flowers is usually brought about.

Honey bees visit the flowers regularly in large numbers; but after extended observation over a number of years, the writer has never yet seen a honey bee trip an Alfalfa flower in the open under natural conditions. This species of bee seems to visit the Alfalfa flower for the nectar alone and is able to extract this from the keel without displacement of the petals: moreover, the honey bee seems carefully to avoid tripping the flower.

Tripping the Alfalfa Flower by Hand.

We do not purpose giving a detailed account of the mechanism of the Alfalfa flower, which causes tripping to take place. A detailed account by Piper will be found in (3: p, 7-9). It will, however, be necessary to give a general account of the way the flower behaves under particular treatment.

If some small object as a toothpick or the point of a lead pencil is inserted between the upper edges of the keel petals, they are forced slightly apart and the sexual column rises up with spring-like rapidity so that the stamens together with the stigma strike the standard with considerable force. The same result may be obtained by simply pressing down on the base of the keel with a pin or a piece of grass stem. When the apex of the sexual column rises up suddenly: the staminal tube, acting like a released spring, curves upward and the anthers together with the stigma are brought against the face of the standard with considerable force.

The anthers being carried somewhat in advance of the stigma are first to strike the standard: this becomes dusted with the pollen from the bursting pollen sacs. The stigma, following immediately behind the anthers, is brought against the standard with considerable force, the impact being sufficiently strong as to cause the pollen grains to become firmly attached to the soft tissue of the stigma, thus rendering self-pollination of the flower practically certain.

At this stage, an interesting question arises as to whether the spring-like force exerted by the sexual column is due to the action of stamens or style. After repeated failures to solve this problem, a method of operating on the flower, which led to the solution of the difficulty was hit upon quite by accident.

The experiment may be carried out as follows:—Select a mature, well-formed, untripped flower. After tripping, carefully slit open the staminal tube, taking care not to injure the inclosed pistil. This operation may readily be performed by inserting the point of a dissecting needle into the base of the tube and working it

carefully upwards to the top. After the slit has been made, the pistil will spring back very slightly, bringing the stigma away from the face of the standard; thus showing that it has been pushed into position and held there by the force exerted by the staminal tube in which it was inclosed.

Methods of Emasculation.

In hybridization experiments, the method of emasculation generally practiced is that of selecting a flower in the bud stage, carefully removing the immature anthers before they have lost any pollen; then, when the stigma has assumed a moist, receptive condition, transferring suitable pollen to the stigma; finally, inclosing the flower in a paper bag or muslin bag until fertilization has taken place.

This method was tested on a large number of flowers, the work being done under varied weather conditions and at various periods of the day—morning, evening, and midday; but the results were far from satisfactory. Very few of the flowers that were operated upon produced seed. This want of success is, perhaps, not very surprising when all is considered.

An Alfalfa flower in the bud stage is very small and not easy to handle. It is also very soft and delicate and difficult to emasculate without causing such mutilation of the flower as will prevent fertilization taking place. Again at this stage of development, the stigma not being in a condition to receive the pollen, it is necessary to wait from one to two days after emasculation before pollination should be attempted. This means further handling of the flower and risk of further bruising or mutilation.

The second method of emasculation which was tested is the one originated and recommended by George W. Oliver of the United States Department of Agriculture, Washington, D. C. (2). The main principles of this system have been followed in the present investigations with some slight modifications in details. The modified method may briefly be described as follows:—

The flower selected to be operated upon should be fully open but quite fresh and in a healthy vigorous condition and not tripped. The operation consists in first tripping the flower so as to expose the sexual organs; then carefully removing the pollen, after which the stigma may at once be pollinated.

It has already been explained that during natural tripping of the flower, the sexual column is released from the keel, and the bursting anthers, together with the stigma, are forced against the face of the standard; thus ensuring self-pollination. Bearing this in mind, it is quite obvious that if we wish to practice cross-pollination, self-pollination must be prevented. This may be brought about in the following manner:—In tripping the flower, the operator, using a small toothpick, presses lightly on the upper surface of the keel at a point near the base: this pressure is sufficient to release the keel petals; thus to allow tripping to take place.

In performing this operation of tripping, it is necessary to insert some object between the sexual column and standard, which will effectually prevent the anthers and stigma from coming in contact with the standard. After testing various articles for this purpose, it was found that the flowering stems of well-ripened Timothy cut into suitable lengths of about one inch served the purpose admirably. By taking one of these stems and using a firm, gentle pressure at the base of the keel, the sexual column is caused to trip gradually against the piece of Timothy stem: this light object is easily held in a position just below the anthers and stigma; and it is sufficiently strong to prevent the anthers and stigma from coming in contact with the standard (fig. II B; fig III B.)

By means of a pocket lens, it may now be observed that the anthers are closely packed around the stigma. Some may have burst and the stigma may be covered with pollen. The next operation is to remove the anthers and free pollen: this may be done by bringing a very fine jet of water to play upon the surface of the stigma and surrounding anthers and, by this means, both loose pollen grains and anthers are carried away very effectually. "For this purpose a small hand-sprayer with rubber bulb and fine nozzle has been

found very suitable."

The stigma should now be carefully examined with a lens to see if all pollen has been cleared away; then any drops of water adhering to any part of the flower should be removed by the use of small strips of thin blotting paper. It was also found that the frayed edge of such paper is very useful for brushing away anthers or pollen grains which may not have been removed by the water spray. When a careful inspection of the stigma shows that it is quite clear and that all anthers and pollen grains have been removed, cross-pollination may be performed.

At this time, the stigma is still held in position by the piece of Timothy stem and is standing quite free from the standard (See fig. IIIc.) so that little difficulty is experienced in pollinating the stigma. The pollen may be collected on the flattened end of a quill or a wooden toothpick and transferred directly to the prepared stigma of the female parent. The toothpick is preferred to a camel hair brush as it is more convenient to manipulate and can much more easily be cleaned or sterilized for future use.

A careful examination of the stigma should now be made to make certain that an abundance of healthy pollen is resting on the stigma (care should be taken to distinguish between pollen grains and empty anther sacs). If found satisfactory, the piece of Timothy stem may be removed. In doing this, see that it is removed at right angles to the sexual column and in such a way as not to displace the stigma or the adhering pollen. The removal of this piece of Timothy stem allows the process of tripping to continue until it is completed. The pollen-covered stigma then presses forward and comes in close contact with the standard; thus, the pollen grains are entrapped and become firmly attached to the face of the stigma; thus completing the operation.

After pollination, the flower is marked by tying a piece of thread loosely around the pedicel. In addition, a small tag is attached to the base of the stem of the flower cluster. On the tag is recorded the parents used in making the cross, and the date. The particulars as to male and female parents, condition of weather, date, and other essential information is recorded on field record sheets with special headings for this purpose. The flower should now be inclosed in a suitable manner so as to protect it from the visits of insects and to lessen the risk of introducing pollen from any outside source.

After testing paper bags which did not prove to be very suitable as they were easily broken or displaced during wind storms, cages sufficiently large to inclose a whole plant were used. (Fig. IV.)

Fig. IV. Method of protecting individual plants. Clover species in foreground: Alfalfa in background.

These cages were made of ordinary wire netting—two inch mesh—and covered with cheese cloth: in size, they were about two and a half to three feet high and about eighteen inches in diameter and held in position over the plant by means of wooden stakes. It was found, however, that the cheese cloth being somewhat close in texture, it was necessary to remove the cage directly after fertilization had taken place; otherwise the plant suffered from being too closely confined. In later experiments, mosquito muslin and tarlatan were substituted for cheese cloth with beneficial results. This method of protecting, emasculating, and pollinating, was practiced on a large number of flow-

ers and gave very satisfactory results. (fig. V).

By using control tests, it was found that flowers emasculated as described above and not pollinated generally proved to be quite sterile; but, when pollinated, a fair percentage produced well-developed seed pods.

In the seasons from 1912 to 1917, a method of clearing away pollen was tested, which gave very satisfactory results. Instead of using a fine jet of water for this purpose, the anthers and any pollen grains

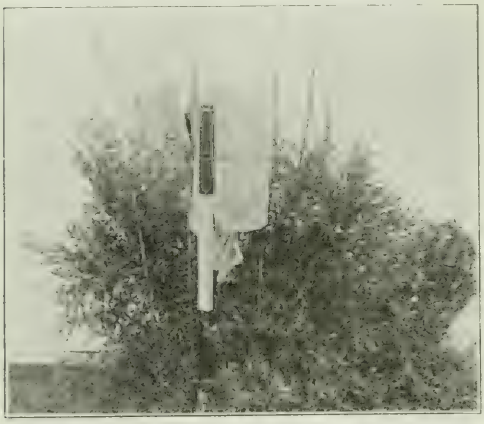

Fig. V. Method of protecting a single branch of a plant. As the plant grows, the muslin-covered cage can be adjusted to any part of the supporting stake.

adhering to the surface of the stigma were brushed away by using the frayed end of a piece of gardener's raffia: this improvised brush was found to be very effective and moreover very convenient; as after each operation, the end of the raffia may be clipped off, thus a fresh, clean brush is available for each operation.

Reliability of Method of Emasculation Tested.

During the course of these investigations, many experiments have been made to test the reliability of the methods of emasculation described above. In one series of tests, out of 189 flowers emasculated, four pods were produced; but only one viable seed. In another series, 66 emasculated flowers produced ten pods which contained no fully developed seeds.

It was found however that under suitable conditions when flowers were carefully emasculated and pollinated a fair percentage of fertile crosses was obtained: if conditions were unfavorable, few or no fertile crosses were obtained. An average result may be taken at about forty to fifty per cent fertile.

Conditions Favorable for Cross-fertilization.

The successful cross-fertilization of Alfalfa depends on several factors which are very difficult to control; hence, it is readily seen that it is impossible to standardize either conditions or methods of working: this is especially evident when the work is being carried on under natural conditions in the field.

I **Weather Conditions.**—As would naturally be expected, the state of the weather affects the work very materially not only on the day pollinations are made but also for at least twenty-four hours previous, and for a similar period after, the work has been done.

Our results show that almost invariably the greatest percentage of fertile crosses have been obtained during a continuous period of fine weather, moderately warm and without rain.

II. **Condition of the Plants.**—There should be sufficient moisture and plant food in the soil to supply the immediate needs of the plant without forcing a too luxuriant growth. A steady and healthy growth is very desirable: too much moisture together with a highly manured soil tends to overproduction of stem and leaf which is detrimental to seed formation. On the other hand, with an insufficient supply of moisture, many of the flowers wither and fall off before fertilization takes place.

Condition of the Pollen.—The pollen should be fully mature; and yet not too old. A good indication as to the proper condition of Alfalfa pollen is obtained by carefully observing the flowers as they are being tripped by hand. During the process of tripping when the anthers burst and the pollen is seen scattered in the form of a fine dust, we have an indication that the pollen is in a good, healthy condition.

To make an exact determinaiton of the

viability and vigor of the pollen it is necessary to make carefully controlled laboratory tests.

Condition of the Stigma.—When in the right condition to receive the pollen, the stigma has a well-rounded surface and has a somewhat shiny appearance. This condition is usually seen as soon as the flower is fully opened. In choosing flowers for the female parent, our usual practice has been to select flowers somewhat immature rather than old flowers. Experiments are under way with the object of trying to determine in what stage the flowers are in the best condition to receive the pollen.

Best Time of Day for Crossing Plants.—

Judging from crossings done at various times in the day (ranging from early morning throughout the day and in the evening) we have no clear indication that the success or failure at one time of the day is greatly different from that of another. The condition of the operator seems to have more effect on the results than the time of day and, other things being equal, the work which is done at a time of day congenial to the worker seems to give the best results.

After pollination, the flowers may be suitably protected by muslin cages in the manner described above. When fertilization has taken place, the protection should be removed so as to give the plant a full measure of air and sunlight, which together aid in the development of plump, healthy, well-grown seed.

The condition of the seed pods should be examined from time to time throughout the summer and when thoroughly ripe should be carefully collected, counted, and a full record made on the sheets prepared for this purpose. The coin envelopes in which seeds are collected should also be clearly marked, showing contents; then the seeds may be stored in a dry and moderately warm place away from mice or other vermin.

Raising Plants from Hybrid Seed.

The system adopted in these experiments is as follows:—The seed is germinated in water in open earthenware dishes and, as the seeds sprout, they are picked off and planted in rows in clean soil previously prepared in suitable pans or flat boxes. In a sample of well-ripened Alfalfa seed, we always find a percentage of hard seeds which do not germinate readily: these will be left behind in the germinating dish. If these hard seeds are properly treated with sulphuric acid so as to soften the seed coat, a rapid germination may usually be obtained.

Method of Hastening Germination of Hard Seeds.

Apparatus Required.

1. 1 doz. clean, dry test tubes.
2. Commercial Sulphuric Acid.
3. Glass stirring rods.
4. Fine strainer (a coffee strainer is suitable for small lots.)
5. A good supply of running water from a tap; also, large pail of water.

Method of Working.—1, Place the hard seeds in a dry test tube; then add sufficient acid to immerse the seeds thoroughly. The seeds will float in the acid, and the mixture should be stirred frequently so as to get all seeds thoroughly saturated. Allow the acid to remain on the seeds for about fifteen to twenty minutes, stirring frequently.

2. **Pour the acid with seeds into strainer**; then dip strainer into a pail or large basin of water so that the seeds are completely immersed. Stir the seeds in water whilst they are in the strainer: this is to wash the seeds free from acid. Any traces of acid may be washed away by holding strainer and seeds under running water from the tap.

The seeds may now be spread out on a plate to dry: a little powdered quicklime dusted on the seeds will hasten the drying, also neutralize any acid which may not have been completely removed in the washing process. These seeds may now be germinated in the ordinary way.

With very hard seeds, it sometimes takes two or more treatments with acid before they are induced to germinate.

In re-treating the seeds; before adding the acid, be sure to dry the seeds thoroughly; then repeat the operations as outlined for the first treatment. By repeated treatments, the hardest seeds can usually be in-

duced to germinate and made to produce healthy plants.

CAUTION.—The above method should be carried out strictly in accordance with instructions given. By improper manipulation, the germinating power of the hard seed may be completely destroyed.

Hardening of Seedling Plants.

After germination of the seed and when the seedling plants have got to about the fourth leaf stage, they are transplanted singly into three-inch flower pots. With a moderate greenhouse temperature, a sturdy growth is encouraged, and finally the plants are transferred to a cold frame to harden off before planting out in the open field.

The germination of the seeds and the manipulation of the plants are so adjusted that plants are usually ready to transplant out in the field from about the middle to the end of May. In the field, the plants are usually spaced from three to four feet apart each way. This allows for the study of the individual plants and also gives the necessary working space between the plants. (Fig. VI.)

If Alfalfa plants are raised in the manner described above, it is usually possible to obtain seeds the same year of planting; and thus the worker is enabled to continue further investigations with a minimum of lost time.

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Fig. VI. Second growth of Alfalfa showing method of spacing plants.
(Note: The plants selected for seed have not been cut.)

Les Insectes dans nos Serres.

Georges Maheux, Entomologiste Provinciale, Québec

Dans sa fable du Lion et du Moucheron, Lafontaine fait jouer à la mouche un rôle qui peint admirablement les services que l'on peut attendre de la gente ailée, la petite bien entendu. Si l'on s'avisait de faire une enquête dans nos centres de colonisation ou de demander aux malheureux habitants de région marécageuse ce qu'ils pensent de certains moustiques, la réponse ne serait guère favorable aux animaux à six pattes. Que les insectes, même les plus nocifs, choisissent nos jardins légumiers au fleuristes, nos vergers et nos champs pour y assoir en plain été les quartiers généraux de leurs troupes destructrices, personne ne semblera en manifester le moindre étonnement. On ne s'attardera pas à peser soigneusement des raisons de nécessité non plus qu'a calculer les avantages pour le moins douteux de la fiévreuse et inlassable activité des hexapodes. C'est que l'habitude fait s'estomper et se couvrir d'un voile épais les angles par trop rugueux ou l'homme s'écorche quotidiennement. C'est l'été : l'insecte pique, mord, gruge, ronge, fore avec un enthousiasme qui ne subit jamais de dépression, l'homme exhale quelques plaintes et s'efforce d'oublier. Le même phénomène s'est répété si souvent sous ses yeux qu'il fonde de croire que tout cela n'arrive que parcequ'il le faut. Mais la froide saison venue, le simple mortel se croit presque l'objet d'une hallucination s'il voit grouiller dans sa demeure les bestioles mal venues. Tout le monde n'a pas heureusement cet impressionnisme exagéré, car tous ceux qui se payent le luxe d'entretenir une serre pourraient facilement offrir, au plus froid de l'hiver, des types entomologiques jouissant de toutes les prérogatives de l'existence.

Une enquête poursuivie au cours des derniers mois dans les principales serres de la ville de Québec, nous permet de présenter au lecteur des individus nouveaux en apparence quoiqu'installés chez nous depuis déjà de nombreuses années. Ce n'est que la nomenclature des formes nuisibles pêche après excès de prodigalité ; ce n'est pas davantage l'exagération des caractères morphologiques qui attirent particulièrement l'attention, mais on ne saurait rester indifférent devant le frappant contraste qui ressort entre la minutie, la ténuité des types que l'on y rencontre et l'étendue des dégats qu'il faut porter à leur débit. A l'observateur attentif, et dont l'oeil a pris l'habitude de scruter le royaume des bêtes, ce concaste n'a rien qui doive provoquer l'étonnement. C'est là un fait qui entre bien dans l'ordre normal, un fait que l'on pourrait aisément illustrer d'exemples multiples et dont la répétition accuse davantage le caractère particulier aussi bien que la puissance dévastatrice de ces minimes animaux.

L'examen attentif des nombreuses espèces qui se jouent des munificences florales cultivées et conservées avec un soin si jaloux entraine irrésistiblement vers une toute autre conclusion.

De la présence de nombreuses formes exotiques il appert que l'introduction chez nous de plusieurs membres d'une flore tropicale a doté nos plantes de serres d'une troupe d'insectes importés, et malfaisants.

L'étonnant, ce n'est pas cette possibilité d'un long déplacement, mais c'est bien cette faculté d'acclimatation à un milieu entièrement différent de l'habitat coutumier et cette puissance de résistance aux facteurs els plus délétères à des vies se présentant sous des dehors si fragiles. Quoiqu'on puisse penser de l'atmosphère artificiel de nos serres qui reconstituent pour ainsi parler le milieu habituel de ces êtres, il n'en reste pas moins vrai que tous les facteurs qui s'exercent en fonction de l'activité vitale subissent des mutations.

Tout récemment encore nous avons été témoins d'un nouveau cas d'introduction au pays d'un insecte fort nuisible. Je veux parler d'un membre de la famille des Tortridices, ordre des Lépidoptères, que certaines importations d'azalées faites au cours de l'automne dernier nous a apporté. Il m'a été impossible de déterminer exactement l'identité de cette tordeuse, mais je reste sous l'impression

qu'elle n'est pas indigène. Son histoire est fort brève. A l'inspection exigée par ceux qui s'occupent officiellement de la police sanitaire des plantes, ces azalées expédiées de Belgique ou de Hollande, présentaient une belle croissance, une forme superbe et pas la moindre trace de parasite. Selon toutes probabilités les oeufs de la tordeuse se trouvaient là, à l'état latent, dans les rides de l'écorce ou le long des nervures des feuilles à leur face inférieure, d'octobre à Noel on ne découvrit aucun symtôme révvélateur de la présence d'insectes. Pendant ce laps de temps la douce chaleur des serres imprimait aux embryons un développement accéléré qui permettait aux minimes larves de rompre la paroi de leur prison vers la mi-décembre.

A ce moment les fleurs si prodigues en teintes richissimes étalaient leurs éclatantes coroles sans que rien ne sembla déparer un si bel ensemble. Quelques jours après le premier de l'an nous trouvâmes des feuilles étroitement liées par des fils tenus et soyeux; une petite larve verdâtre, parfois fauve, était blottie dans cette cachette. En quelques jours une bonne moitiés des azalées montraient les signes évidents d'un voisinage délétère; à plusieurs endroits l'apareil foliacé laissait voir des vides bordés de traces révélatrices de mandibules brouteuses. Au commencement de février les chrysalides nués pendaient aux bourses de soie et elles libéraient à la fin du même mois un petit papillon gris argent de trois-quarts de pouce d'envergure. Répétées deux fois la semaine les fumigations de tabac pratiquées dans ces serres n'ont pas paru inquiéter autrement les petits broyeurs. Pris par surprise les jardiniers n'ont pas d'avantage songé à utiliser contre eux quelque poison arsénieux qui n'aurait pas manqué, appliqué au bon moment, de mettre un terme à la voracité des chenilles.

Sans prétendre trancher la question d'identité, toujours délicate chez ces espèces aux dimensions réduites, la chenille de hôte bien connu des serres où foisonnent roses et oeillets, l'Archips (Cacoecia) rosaceana. Je laisse aux lépidoptéristes rompus dans l'art de déchiffer sous le microscope les caprices morphologiques de fixer le nom de l'espèce dont il s'agit ici.

Aussi bien, est-ce le seul insecte venant d'outre mer qui ait cette année capté notre attention. Comme je l'ai dit plus haut nos serres hébergent plusieurs commenceaux qui appartiennent à la faune tropicale ou semitropicale; en nombre ils accaparent le premier rang, les types de notre zone ne comptant que quelques rares représentants.

Au premier groupe se réfèrent bon nombre de suceurs venus chez nous avec les plantes hôtesses de leur habitat normal. De tous les insectes que l'entomologiste chasse dans les serres chaudes, il n'en est guère de plus difficiles à exterminer que les cocheniles. Protègées par leur carapace, impermébilisées par leur sécrétions, elles ne cèdent généralement qu'au coup d'éponge ou de brosse vigoureux et souventes fois répété. Leur survivance tient du prodige. Des lavages répétées à l'eau fortement savonneuse additionnée d'ingrédients variés ne réussissent pas à effecer complètement leurs traces. Toujours il reste, protégé par quelque repli ou caché au bon endroit quelques individus qui se chargent de propager l'espèce; on ne peut nier qu'ils réussissent admirablement et au-delà des désirs des jardiniers obligés de leur faire une lutte sans merci.

Ennuyeux entre tous sont les poux blancs des serres groupes sous le nom gènèrique de *Pseudococcus.* Diverses sortes de fougères, de palmiers permettent aux masses floconneuses et blanches de se nourrir ed leurs sucs, mais la plante qui reçoit leurs attentions les plus suivies, c'est sans contredit le Coleus. Dans une serre, cette plante est, semble-t-il, le dernier refuge des poux blancs, le mets préféré. Fumigations, immersions, aspersions bien dosées réussissent toutefois é les maintenir en échec, mais il y faut mettre une persévérance, une ténacité dont tous les jardiniers n'ont pas le secret.

Parmi les cochenilles qui méritent mention on peut enumérer les suivantes: la cochenille à coquille moile (*Coccus hesperidum*) favorite des fougères, palmiers, et autres plantes; la cochenille des fougères (*Homichionaspis aspidistrae*) commune sur toutes les espèces de fougères; la cochenille rouge de Floride et le kermès de Bouché se rencontrent sur un grand feuillage dont la liste serait longue si on la voulait complète; on y pourrait ajouter

l'abutilon ou érable de maison dont la culture, soit en serre soit dans les appartements ne se conçoit guère sans le compagnonnage obligé des cochenilles.

Dans le second groupe, celui des insectes appartenant à notre zone ou à une zone transitoire voisine se trouvent surtout les pucerons dont nous nourrissons plusieurs espèces. A côté des pucerons verts bien connus de tous les amateurs de fleurs et qui se logent sur une étonnante variété de plantes, il fait mentionner tout particulièrement le puceron des chrysanthèmes. C'est en effet un hémiptère de couleur noire et qui parait manifester un exclusivisme prononcé dans ses goûts; on le voit sur les chrysanthèmes et presque pas ailleurs; et encore faudrait-il souligner son appetence pour les variétés jaunes et roses de préférence aux variétés blanches et rouges. *Macrosiphum sanborni* se détruit aisément avec les solutions à base de nicotine, mais celles-ci ont le grand défaut de tacher les fleurs aux tons pâles. C'est pourquoi on a cherché à trouver quelque autre remède qui ne présentât pas pareil inconvénient. Un composé alcoolique de pyrhètre, de fabrication récente, est appelé à rendre des services appréciables pour cette fin particulière.

On peut accoler à la liste des insectes nuisibles certain acarien fort ennuyeux dans les serres, la mite du cyclamen (*Tarsonemus pallidus*). En dèpit du nom vulgaire qui lui est échu, cet acarien s'attaque aussi bien aux cinéraires et c'est même à ces plantes au feuillage fragile que nous l'avons vu causer le plus de dégâts. Il résiste peu aux fumications ou aux vaporisations à base de nicotine, à condition de le pourchasser sans relâche dès son apparition; à défaut de ce faire il a tôt fait de transformer en plantes disgracieuses les cinéraires les plus magnifiques.

Ajoutons encore les limaces, ces mollusques dont les jardiniers ne se méfient pas suffisamment. Combien de feuilles de plantes disparates que l'on attribue à tort à divers insectes quand le vrai coupable n'est autre qu'une limace se défilant prudemment le jour mais très active la nuit. On peut suivre les limaces à leurs traces: c'est un mince ruban luisant qui n'est autre que le mucus desséché que secrète l'animal au cours de ses pérignihations. Débris de toutes sortes, dessous des pots, cavités plus ou moins profondes creusées dans la terre qui recouvre les bâches: tout est bon pour fournir une cachette à la limace. De la chaux pulvérisée ou du sel épandus sur la terre en cordons continus constituent des barrières infranchissables à ces masses rempantes et en exterminent un bon nombre.

La seule maladie crytogamique importante de nos serres cette année c'est la rouille du muflier. Affection de découverte relativement récente, la rouille du muflier (*Puccinia anthirrini*) s'est rapidement propagée de par le pays. Les méthodes de contrôle sont encore dans l'enfance et nous ne pouvons encore qu'expérimenter. Nous avouons n'avoir trouvé aucune méthode vraiment efficace. L'effet de la maladie se troduit le plus souvent par une croissance rachitique, les plants atteints faisant mine de pigmés à côté des plants sains. Certains jardiniers croient que la rouille affectionne quelques variétés déterminés, tandis que d'autres variétés seraient en quelque sorte immunisés. Comme la question est grosse de conséquences, elle continuera de faire l'objet d'études suivies, déjà bien en voie du reste au Collège Macdonald, comme on peut le voir par l'avant dernier rapport de la Société de Québec pour la protection des plantes.

Nous n'avons pas la prétention d'indiquer au jardiniers de profession en charge d'une serre les différentes formules d'insecticides et fongicides susceptibles de mettre en échec insectes et maladies. La plupart savent fort bien comment procéder. Le grand défaut réside dans le fait que plusieurs n'ont pas compris tout l'importance d'une lutte systématisée et commencée dès l'apparition des premiers symptômes. C'est pourquoi nous suggérons aux intéressés de ne jamais se fier à la belle apparence de leurs plantes pour en conclure que rien n'est à craindre. Il convient plutôt de procéder à des fumigations régulières qui tueront le plus grand nombre des parasites avant même que l'oeil humain puisse soupçonner leur présence. Il faut aussi ne jamais négliger de choisir les variétés les plus rustiques et éliminer sans calcul decevant les sujets chétifs, anémié, maladifs. Prévoyance est ici synonyme de succès, et ce sera longtemps encore la formule la plus sûre de protection des plantes de serres.

La Cooperation en Agriculture.

J.-B. Cloutier, Inspecteur des Co-opératives, Québec.

I

LES DEBUTS.

Connaître soi-même la coopération la présenter au moment propice, la faire étudier par les intéressés et disposer d'une règlementation bien suivie pour chaque branches d'activité coopérative tels sont les soins principaux devant accompagner à des débuts la coopération en agriculture.

Connaître soi-même la coopération.

Etymologiquement, le mot coopérer siknifie la méthode par laquelle on opère conjointement avec quelqu'un.

A ce compte nous diront certaines gens, la coopération est ce qu'il y a de plus simple et c'est vraiement pas la peine de faire école pour enseigner les vérités de Monsieur La Palice.

Il est en effet notoire de constater (et c'est bien dommage) qu'une foule de personne ne voient ou n'ont vu dans la coopération rien autre chose que d'agir en commun, de produire en commun, etc.

Tout chercheur qui désire s'assimiler les principes régissant ce système social nouveau se trouve dès le début en présence du fait suivant: à savoir que la coopération ne vaut seulement pas sa signification étymologique, mais bien par ce que l'on est "convenu" d'atendre d'elle.

Ecoutons M. A. Nast dans les "Principes Coopératifs" répondant à la question: Que sont les coopératives?

"Les coopératives sont des institutions sociales se définissant à la fois par leur but et le moyen employé pour parvenir à ce but.

"Le but, c'est suivant l'objet de la coopérative, soit de faire réaliser aux intéressés la plus grande économie possible sur l'acquisition ou la location des choses dont ils ont besoin, soit de leur faire obtenir la plus forte rémunération de leur travail.

"Le moyen, c'est l'union entre les personnes désireuses de se procurer le même avantage et la formation d'une entreprise commune avec un capital provenant des apports de tous les associés.

"Pour que le moyen fonctionne de manière à atteindre le but, les excédents sociaux sont pargagés entre les acheteurs, les emprunteurs les locataires ou les producteurs, suivant le cas, au prorata de leur chiffre d'affaires ou de travaux avec l'organisation après prélèvement des sommes à affecter aux services et aux réserves prévus par les statuts en vue du rayonnement de la coopération (développement de l'entreprise, propagande, oeuvres de solidarité, etc...)

Nous voyons percer de suite dans ce programme, un rare esprit de justice en même temps que de solidarité qui fait de la coopération une organisation à part, autonome et nécessairement de longue durée.

Pour l'actionnaire dans une compagnie peu lui importe le caractère, la rapacité ou quelque fois même la malhonnêteté de l'entreprise, pourvu que son 8, 10, 15 ou 20 p.c. de dividende lui soit déservi régulièrement, mais autre chose est de l'entreprise coopérative; la coopérateur étant lui, le client de l'entreprise dont il est le bénéficiaire ne saurait se tromper lui-même en se pourvoyant de marchandises frelatées ou à prix exhorbitants.

Il s'ensuit pour la coopération un ensemble de données particulières s'imposant au raisonnement de celui qui l'étudie, à celles généralement connues, du régime capitaliste sous lequel nous vivons, mais données étrangères et même antagonistes en dehors desquelles le succès d'une coopérative est impossible.

Présenter la coopération au moment propice.

L'allusion aux "sept vaches maigres" lorsqu'il s'agit de coopération, si elle n'a pas une valeur capitale, (car nous aurions tort de juger les hommes pire qu'ils sont) à tout de même une part de vérité et possède de fameux exemples à son crédit. Les "Pioniers de Rochdale", pauvres tisserands qui ont fondé la première coopérative, étaient poussés par la nécessité.

Le moment propice pour fonder des coopratives semblerait être à la suite de mauvaises années, comme cette année, par cemple, à la suite d'abus faits par les intermédiaires sur les prix ou qualités des grains, graines de semence, engrais chimiques, alimentaires, etc. De ces derniers

maux, les cultivateurs sont des victimes permanentes et en tout lieu.

Aussi nous a-t-il été donné dans le passé de nous rendre compte plusieurs fois de la puissance, de la nécessité, et d'une manière très évidente, trop évidente même en ce sens que nous avons profité de telle ou telle circonstance en l'exaltant un peu, pour fonder trop de coopératives peu sûres et pas assez de vraies coopératives.

L'argument nécessité n'est donc pas le seul à évoquer, ni même n'est nécessaire pour fonder une coopérative vraie. Nous devons plutôt viser à atteindre le raisonnement du futur coopérateur et lui faisant comprendre et en lui prouvant chiffres en mains qu'une coopérative est pour lui une affaire meilleure que tout autre. Il ne doit pas être mis sous l'impression qu'une coopérative est une planche de salut qu'il rejetera sitôt hors de danger, mais bien plutôt un puissant vapeur qui devient sa propriété avec ses voisins, selon sa part de travail, et sur lequel, tous seront désormais à l'abris des tempêtes.

Les futurs coopérateurs devraient tous être bien instruits du rôle qu'ils auront à jouer dans leur organisation, soit par une campagne de presse, ou ce qui est mieux, par des conférences appropriées à chacune des situations spéciales dans lesquelles ils se trouveront. Le moins que l'on devrait exiger à la naissance de toute coopérative, serait d'avoir sous la main, pour l'organisation à mettre en marche, un homme, un gérant comprenant bien la coopération.

En coopération comme en toute autre chose, il est plus facile de prévenir que de guérir. Une mauvaise méthode d'achats, de vente, est-elle entrée dans les habitudes des coopérateurs, il est très difficile d'en changer le courant. Une coopérative où l'esprit capitaliste domine revient rarement à la vraie coopération. Nous pourrions en dire autant des coopératives de parti, de castes, ou autres.

En résumé, la coopérative sera présentée à l'agriculteur parce que c'est une organisation supérieure à celles dont il se sert présentement, parce qu'il y trouvera un moyen économique plus efficace que tous les autres d'améliorer sa condition sociale grâce à des ententes faites à son profit et au-dessus de toutes divisions d'idées, ententes que seule la vraie coopération peut réaliser.

Disposer d'une règlementation efficace.

L'on ne saurait faire mouvoir un groupe de coopérateurs sans une règlementation bien connue et bien suivie par chacun des intéressés.

Cette règlementation vient compléter et renfermer dans des cadres définis le travail d'éducation coopérative fait au moment de jeter les bases de 'lorganisation. Sans vouloir imposer à ses membres l'obligation d'acheter ou de vendre tous leurs effets par son entremise, la société peut néanmoins taxer de blâme des membres qui, prix pour prix, qualités pour qualités, achètent ou vendent à l'intérieur.

Dans beaucoup de coopératives il y a obligation pour le membre d'apporter tout ou une partie de ses produits à l'organisation; ces sociétés fonctionnent généralement bien.

Mais ce qui importe le plus pour une société, c'est de se rendre attrayante et "désirable" aux membres par une règlementation ni trop sévère ni trop large, mais surtout appuyée sur une éducation coopérative avancée chez les coopérateurs.

Si les coopérateurs ont le droit de savoir que leur coopérative prend trois ou cinq pour cent de profit sur les achats et ventes, il faut aussi qu'ils soient préparés à cette connaissance par la certitude que ces profits leur appartiennent en propre.

Quant à savoir si une société coopérative doit conserver toute entière la capacité d'achat ou de vente de tous ses membres cela n'est pas douteux. Au besoin, une société se contentera de certaines lignes avec lesquelles elel est sûre de pouvoir supporter la concurrence extérieure. Il est fortement conseillé aux sociétés coopératives d'adopter des marques particulières de produits, des classifications spéciales, afin de dérouter le plus possible la compétition.

Mais le domaine où la coopérative doit au plus tôt se réfugier réside certainement dans la fédération des sociétés locales. Grâce à une coopération centrale les sociétés peuven de plus en plus s'affranchir de la concurrence locale et voient s'augmenter sans cesse la marge des revenus é prendre ou à économiser sur les achats faits par plus grandes quantités et à de meilleures conditions.

Ici encore, la règlementation coopérative verra à contrôler les achats ou les ventes de la société locale de façon à ce que pas un sou de marchandises ne soit acheté ou vendu en dehors de la coopération centrale.

Il est bien compris qu'une bonne règlementation doit interdire tout achat à crédit dans une coopérative. Outre que les coopératives n'ont généralement pas le moyen de s'y livrer, elles se doivent à elles-mêmes d'êtres des sociétés moralisantes et l'habitude du crédit est une funeste habitude.

La répartition coopérative des profits doit être profondément entrée dans les moeurs des coopérateurs pour maintenir l'"élan" coopératif. La "ristourne coopérative" est à la base du système coopératiste comme le dividende est à la base du système capitaliste, mais avec des effets bien différents. Avec la répartition des profits suivant le chiffre d'achats et de ventes de chaque membre, laquelle répartition n'est que la plus grande justice, une société coopérative commande la fidélité de tous ses membres. Le "trop Perçu" remis au sociétaire peut même suppléer dans une certaine mesure à une règlementation insuffisante. Le membre comprend que s'il paye un peu cher aujourd'hui, le surplus lui reviendra en bonus, et en somme il n'aura rien perdu.

Il y a en Europe des coopérative qui vendent dix et vingt-cinq pour cent plus cher que des compagnies faisant les mêmes opérations commerciales à côté (Gand, Belgique).

Ici même dans la province de Québec, des producteurs de tabac ont consenti à des cotations relativement bases pour leur récolte afin de mettre leur coopérative sur pied et toucher par la suite une ristourne coopérative plus élevée (St-Césaire).

Si la bonne règlementation et la parfaite intelligence de la Coopération ont pu être pratiqués avec succès chez nous comme ailelurs, si même on a pu en certains endroits réaliser des merveilles d'organisation (wholesale anglaise), il n'y a pas lieu de désespérer jamais de la coopération comme puissant facteur de progrès en Agriculture.

ADIEU DU Dr. SAUNDERS AUX CULTIVATEURS CANADIENS.

Lu à la dernière exposition provinciale des semences, tenue à Québec les 13 et 14 mars.

Je trouve avec le plus vif regret que l'état de ma santé ne me permet pas cette année de visiter la ville de Québec à l'occasion de l'exposition annuelle de grains de semence. Depuis la première fois que j'y suis allé je n'ai jamais manqué d'y assister. Il me faisait toujours grand plaisir de voir la collection magnifique de grains de semence (car cette exposition est peut-être la meilleure dans tout le Canada), de rencontrer quelques-uns de l'élite des cultivateurs de la province et de leur parler du but des recherches que je poursuis à Ottawa et sur les fermes succursales.

Je regrette surtout cette fois-ci l'impossibilité de vous rencontrer, parce que je fais mes adieux à l'agriculture; et il est très peu probable que j'aie, à l'avenir, l'occasion de vous revoir.

Je désire vous remercier de m'avoir toujours si bien accueilli, non seulement ici dans cette assemblée, mais aussi chez vous, sur les fermes que j'ai eu le plaisir de visiter. Le charme des paysages québecois et de votre vie rurale m'a souvent touché, et mes idées sont devenues plus larges depuis que j'ai connu le Canadien-français chez lui. J'aimerais bien que beaucoup des Canadiens-anglais eussent ce privilège et que beaucoup d'entre vous eussent l'avantage de mieux connaître le Canadien-anglais, car la grande difficulté dans notre patrie, c'est que les deux races principales ne se connaissent pas. Il est si facile de mépriser les gens qu'on ne connaît pas et si facile de les aimer quand on les connaît.

Depuis quelques années je m'intéresse beaucoup à l'étude de la race et de la littérature françaises, et j'ai décidé d'aller en France, aussitôt que possible, pour continuer là mes études sous les meilleurs auspices. A mon retour au Canada, si je reviens, j'espère que ma santé me permettra de faire quelque chose (si peu qu'il soit) pour aider au rapprochement des deux races.

Vous voyez donc que si je vous abandonne au point de vue agricole, je ne vous oublie pas. Je changerai d'oeuvre mais je continuerai à faire mon possible pour le bien-être de notre pays.

Corn and the Milling of Corn.

C. W. Stanley, Chemist, Canada Corn Products Co., London, Ont.

It is now generally conceded that Indian corn or maize is native to America, since the contention that maize was cultivated in Europe before the discovery of America has not been proven. The exact place of origin is a matter of conjecture but according to Harshberger, the cultivation of maize probably originated on the high plateau of central or southern Mexico sometime before the beginning of the Christian Era. In Mexico and Peru specimens have been found in ancient ruins that are two or three thousand years old. It is said that the Incas of Peru built large storerooms for corn to prevent famine in case of crop failure. Ears of corn have been found in old Indian tombs. These had been deposited with the deceased as provisions for the long journey to the "happy hunting grounds" and show that corn had an important part in the religious rites of these people.

Corn has never been found growing wild. This means, either that wild corn was extinct before the days of botanists, or it is so different from the cultivated form, that it is unrecognizable. The latter theory is generally favored by botanists and they think the probable primitive form is the Mexican Teosinte. Teosinte does not look much like corn but the relationship must be close, for hybrids obtained by crossing corn and teosinte produce seeds which germinate. In all other known cases hybrids from distinct grass species are sterile.

From Mexico corn spread north as well as south, reaching Maine sometime around 1000 A.D. Corn, especially flint varieties and a soft corn known now as squaw corn, was extensively cultivated by the Indians, and was their chief cereal food when Columbus discovered America, at which time most of our common cereals were unknown here. Corn was introduced into Europe from America and it is now cultivated to some extent in nearly every country.

Corn Statistics.

A glance at the world's crop report for 1920 shows the relative importance of corn.

Corn — 3,720, 969,000 bushels.
Oats — 2,924, 940,000 bushels.
Wheat— 2,623, 318,000 bushels.

These totals do not include Russia and some of the other disorganized countries of Central Europe. The United States produced 3,199,099,000 bushels of corn or over 75 p.c. of the enormous amount. A few years ago, Illinois, Iowa, Kansas, Nebraska and Indiana, had 47 percent. of the total corn acreage and 57 percent. of the production. In these states at that time were also 50 p.c. of the swine of the U. S. and 33 p.c. of the beef cattle. Texas, Ohio, Oklahoma, Kentucky and Tennessee are also great corn producing states and along with the first named are in the famous section known as the Corn Belt.

Although there are several distinct kinds of corn, only two, dent and flint, are grown extensively. These are popular today because of their yielding and keeping qualities and because of their adaptation to a great range of climate. There are numerous varieties of both flint and dent corn, the majority of which have been originated in comparatively recent times, either by crossing or selection or both. Because of the way corn responds to crossing and selection it has been a favorite with plant breeders and nearly every year new varieties with some special quality are introduced. The results in Bulletin 128 of the Illinois Experiment Station show what can be done by selection from a chemical standpoint. A single variety was taken and after ten years' selection for high and low protein and high and low fat content, the high protein corn contained nearly twice as much protein (14.26—8.64 p.c.) and the high fat corn nearly three times as much fat (7.37—2.66 p.c.) as the low.

A popular problem has been pushing the corn belt northward. Varieties have been developed with a view to quick maturity and the fact that some will mature in about 80 days in Manitoba, while others in the Gulf States take 200 days, shows what has been done. Generally speaking the longer the growing season up to 180 days, the greater the yield but available moisture, fertility of the soil and farm-

ing methods are limiting factors that often more than compensate for the advantage of a long growing season. For instance Florida with a long season has an average yield of little over 10 bushels per acre, while Canada, hundreds of miles farther north, has an average yield five times as great. The corn crop often suffers from lack of water, even in districts where the annual precipitation is high, because the water is not available at the time when it is most needed. Texas has a fair annual rainfall but many of their rains are extremely heavy, with the result that much water is lost in run-off. It requires from 15 to 20 tons of water, available to the plant, to produce one bushel of corn. The transpiration and evaporation by the crop of this amount of water shows the importance of tillage to prevent both run-off and evaporation from the soil, thereby modifying the effect of the rainfall to a considerable extent.

Corn requires a soil with plenty of nitrogen, in fact it will give large yields of grain on soils so rich that other cereals would produce rank straw with very little grain. Corn seems able to utilize the nitrogen of coarse organic matter long before it has reached the advanced state of decomposition required by oats and wheat. Nitrifying bacteria are the agencies which make organic matter available and as these require plenty of air for their work, it is necessary to have drainage to prevent a cold water-logged condition of the soil.

In the corn belt the ears are often the only part of the plant that is harvested. These are husked and stored in slatted cribs to partially dry, after which they are shelled and the corn marketed. A huge amount of grain finds its way to the big terminal elevators at Chicago and other large cities, where it is stored until required for either the local or export trade.

Nearly nine tenths of the corn crop is used for feeding stock, the remainder being used for manufacturing starch, hominy, glucose, corn oil, alcohol, breakfast foods, corn meal, corn flour and hominy feed. A small amount of husks is used in matting, some stalks and pith in packing while a small percentage of cobs find a use in the old fashioned tobacco pipes. Southerners of both races are fond of corn meal and hominy and with them corn in one form or another takes the place of wheat as a cereal food.

Milling Corn.

In the south many small mills are equipped to grind the corn with stones. In this way everything but a small amount of chaff removed by a fan remains in the meal so that it has practically the same composition as the whole grain. It is said that the cooks always pass the meal through a sifter and remove a portion of the bran which has escaped the grinding process. Owing to the presence of the germ the meal has a peculiar rich oily flavor and when once a taste for this has been acquired, the degerminated meal with its low fat content does not satisfy. However it is necessary to consume the whole corn meal shortly after making, as in hot weather it rapidly deteriorates, develops excessive acidity and often becomes rancid and musty. Owing to the poor keeping qualities of whole corn meal, the stone grinding method has been replaced to a great extent by the roller process, a process very similar to that used in making flour.

In the mill with which the writer is associated the process is as follows:—The shelled corn is received in car lots and carried on a belt conveyor to a separator where the dust broken cobs and very light grains are removed after which it is stored in concrete silos. As the corn is required it is removed from the bottom by means of a screw conveyor, taken to a small separator where all the dust, chaff etc., which escaped the first separator, as well as the small, very large and foreign kernels are removed. The cleaned corn next passes over a powerful magnet to remove any nails or bits of metal, after which it is conveyed to the mixing bin. From there the corn is fed into a tempering device, consisting of two metal tanks, one above the other, where water or steam or both can be added in the desired quantities to thoroughly loosen the bran and germ. The amount of moisture added, varies from 3.0 to 6.0 p.c. depending largely on the amount of water in the raw corn. The nature of the corn determines whether most of the water shall be added as the corn goes into the first large tank where it will stand several hours, or as

it goes to the second small tank where it will remain only a short time. The tempered corn goes by gravity to the degerminator where the kernels are split open, the bran knocked off and the germ loosened from the hominy part of the kernel. This mixture of broken material descends to a dryer consisting of revolving horizontal cylinders equipped with steam coils and a suction flue to remove the moist air. The hot material then passes through the coolers, an apparatus somewhat similar to the dryer but minus the steam coils. From it the cooled mixture is elevated to the sizing reels which remove the large flinty portions, that are known as pearl hominy or grits. The grits are cleaned in aspirators and all adhering dust, bran and bits of germ are removed and returned to the stream containing the smaller portions. The grits are again sized to remove any kernels which escaped being in the degerminator and finally dried and cooled again in a special dryer and cooler. This is necessary for safe keeping since the grits owing to their size, dry slowly in the first dryer. The remaining stock, consisting of small grits, germ and bran, is passed through a series of break rolls and thoroughly screened and aspirated after each break. The germ flattens out on the rolls and is removed either by the screen or the aspirator. The final product of the second and third rolls is a fancy table meal; that from the last roll is corn flour, a commodity used in pancake flour, for dusting bread pans in bakeries and for filler in sausages. The germ,bran and dust from the aspirators and the shrunken and foreign kernels from the separators, all go into the feed stream and are ground producing a material called hominy feed, which is particularly valuable for its high fat and low crude fibre content. The percentage of fat varies in different mills and with different corn but it usually runs from 7.5 to 9.0 p.c.

The process as outlined sounds simple but a modern corn mill with its conveyors, elevators, tempering devices, degerminators, dryers, coolers, sizing reels, both wire and silk, aspirators, dust collectors, break rolls and grinders is quite complicated and requires skilled millers to operate as well as a chemist to analyse the products and see that the composition of the feed is equal to the quarantee and that nothing which is liable to spoil on account of excessive moisture, fat or acidity is shipped out. As the finished products are nearly always lower in moisture than the raw corn, it is necessary for the chemist to obtain as high a percentage of moisture as is consistent with good keeping qualities to prevent high milling loss.

Moisture, Acidity and Fat.

Until recently the amount of corn products manufactured has been gradually decreasing from year to year. The chief reason for this was inefficient or unscientific methods of manufacture, which resulted in products that were of poor keeping quality. From research work carried on by the Bureau of Chemistry of the U.S.Dept. of Agriculture, it has been found that corn products, which rival wheat compounds in value as human food, can be made and handled with very little danger of spoilage. There are many factors influencing the keeping qualities of corn and corn products but from a chemical standpoint the most important ones are Moisture, Acidity and Fat. Of these three variables, the degree of acidity is the most important criterion in judging the quality, as it is the only chemical factor showing a decided change as the material deteriorates, but numerous analyses in our laboratory and government investigations show that these three factors are closely related. With uniform moisture the increase in acidity varies more or less directly with the fat content and with uniform fat; the acidity increases more rapidly as the percent of moisture increases. For instance a sample of hominy feed containing 8.5 p.c. fat and 12.7 p.c. water showed an acidity of 20.2. After two weeks in a warm place the acidity was 38.6. Another feed sample with 10.5 p.c. moisture and 8.6 p.c. fat increased from 21.0 to 28.4 in the same length of time. A sample of corn meal with 16.4 p.c. of water and 1.0 p.c. fat increased from 9.5 to 16.8 in two weeks while another sample with 13.0 p.c. water only increased from 11.0 to 20.4 in six months.

In commercial grading of new corn the percentage of moisture is of primary importance, since it influences the rate of

acid development and the subsequent keeping qualities. From the time of harvest until along in the following May, the corn arrives at the terminal markets with a percent of water above normal and is graded No. 2 or 3. After a time the moisture becomes more uniform and approximates 13.5 p.c. or lower. The corn then grades No. 1 unless it contains numerous unsound or damaged kernels in which case the grade is lowered. The writer has found that the percent of moisture as determined by the grain inspectors averages around 1.0 p.c. too low and in some cases reaches 2.0 p.c. In only rare instances do they show a higher moisture than that determined in our laboratory.

In grading old corn the degree of acidity is most important. Corn with a high moisture content is sometimes artifically dried at a later date to prevent spoilage. Using the moisture test to grade this class of corn would give misleading results since the quality would be lowered during the period the corn was high in moisture. The Bureau of Chemistry has found that the "degree of acidity" of the corn is in direct relation to the factors of moisture, quality, soundness, and percent of damaged kernels. All corn, even when harvested, shows some acidity and as the corn becomes older this increases, owing almost entirely to the changes taking place in the germ. Damaged and broken kernels admit the air and hasten the reactions.

In order to classify corn as to quality by means of the acidity test, it is necessary to fix certain limits, but as in all empirical standards a certain amount of variation must be allowed. As a result of numerous tests and careful inspection, the following standards have been chosen. Corn with an acidity above 50 degrees is always very poor and has reached such an advanced stage of deterioration that a glance at it would be sufficient. Any corn over 30 is very low quality. Between 26 and 30 it has deteriorated enough to be considered unsound although it may appear of fair quality to the eye. Between 22 and 26 it is in fair condition while corn below 22 is of first class quality from a commercial standpoint.

One car of corn received by this firm was billed 14.80 p.c. moisture and graded No. 2. An analysis showed an acidity of 30.5. Hominy feed made from it showed 46 degrees of acidity. If this corn, all of which was used for feed, had been graded according to the acidity, it probably would have been No. 4.

Since the acidity of corn is highest in the germ and nearly all the increase is due to it in the presence of moisture, the two important factors in the manufacture of corn products with good keeping qualities, are the proper removal of fat and the absence of excessive moisture. In hominy feeds for livestock, an acidity higher than that permissable for human beings is not objectionable but in these feeds the moisture must be lowered to compensate for the increased fat. While the maximum amount of water consistent with proper keeping qualities has never been definitely settled we have found that corn with 14 p.c. moisture or less, corn meal or flour with 14 p.c. or less and hominy feed with 10.5 p.c. or less, are secure from undue deterioration if kept in a dry, ventilated place. It might be supposed that corn flour would require a lower moisture content than meal owing to its finer nature but it contains considerably less fat.

With the percentage of moisture so important a proper method of drying the products is necessary as well as a rapid method of determining the extent of the drying. For control work the ordinary method of drying in an oven is too slow. Brown and Duvel have made a tester suitable for the rapid determination of moisture in grains and other substances. The method consists of heating a known weight of the sample in a suitable flask with a good grade of mineral oil that has a flashing point around 200 degrees C, and in condensing, collecting and measuring the distillate. The apparatus has been standardized by the inventors, although every chemist would test the recommended temperatures carefully before accepting any results as correct. The apparatus is a great boon to millers as they can have the report from the chemist in little more than half an hour after the sample it taken.

The Canada Corn Products Co. has made numerous large shipments of corn meal to

the West Indies, the consignments being from three to four months in transit, including a long sea voyage. The meal always arrived in good condition and apparently satisfied the tastes of the natives.

The demand for corn products is increasing due largely to the activities of the American Corn Millers' Federation. It is hoped it continues to do so as corn, in many forms is a valuable human food.

West India Agricultural College.

During the months of December, 1921, and January, 1922, the *Agricultural News*, published at Barbados for the Imperial Department of Agriculture for the West Indies, featured a series of articles on the proposed agricultural college which is to be established at Trinidad. Editorial reference to the matter is also found in the *West India Committee Circular*, in the London *Times* and in *Nature*, the English scientific journal. An outline of the progress so far made and the purposes of the new institution may be of interest to Canadian readers.

The Secretary of State for the Colonies (Lord Milner) in August, 1919, appointed a committee to enquire into the advisability of establishing an agricultural college in the West Indies. The report of this Committee, submitted the following year, was highly favourable and, pending application for a Royal Charter, it was suggested that the college be incorporated under the Companies' Act as a Charitable Company "limited by guarantee not to declare dividends or profits". In this way all the legal machinery for incorporation and management is provided and registration is possible without the use of the word "limited", thus distinguishing it from commercial concerns. This recommendation was subsequently carried into effect.

The purpose of the college is to give a systematic, practical and scientific training in tropical agriculture which may be comparable to the training now being given in similar institutions in the U. S., Canada and elsewhere in temperate climates. While primarily, therefore, the college is for West Indians, it was felt that students would also be attracted from other tropical countries, and elsewhere, for special training in such subjects as the manufacture of sugar and sugar technology in general.

A general course will be provided for those intending to take up commercial work. This will be the main course and will lead to a Diploma. Shorter courses will also be necessary, especially for those with agricultural training coming from temperate climates to take up work in the tropics. They will find the new college at Trinidad of immense value, especially in such subjects as entomology, mycology and chemistry.

The erection of buildings is being given immediate consideration, an architect having been appointed in September, 1921.

The Governing Body is composed of some sixteen members. Sir Arthur Everett Shipley is Chairman, Sir David Prain, Vice Chairman and Sir Francis Watt, Principal.

The decision to build and equip an agricultural college in the West Indies will be acclaimed by agriculturists throughout the world, not only because of the value of tropical products but chiefly because of the opportunities offered for the application of science to production methods. There will also be developed that highly necessary knowledge of the details involved in the production of the important raw materials for which the West Indies are so well known. That knowledge will be of the greatest value to those handling tropical products in other countries as well as to the producers themselves.

The effect of this new institution will not be confined to the West Indies. Agriculturists in many other countries will follow its development with the greatest interest. Some will undoubtedly take advantage of the training which it offers and it will serve as an incentive to the establishment of similar colleges in other parts of the Empire where their need has long been felt.

F. H. G.

The Copenhagen Conference. *

George H. Clark, Dominion Seed Commissioner, Ottawa

The International Conference on Seed Control had been held periodically in Europe prior to 1914. The conference held during June of this year was called by the Danish Government at the request of several of the other governments of Europe. The time and place for the next conference has been fixed for June 1924 at Cambridge in England.

There were at the Copenhagen conference in June last representatives from sixteen European countries. The conference really became one on seed testing as distinguished from seed control. Discussions were in the English, French and German languages. The latter language seemed to predominate. The chairman of the conference, Professor Dr. Johansen, was equally as adept at giving translations of addresses or discussions from his own shortland notes as he was graceful, in the capacity of chairman.

Because of the need of translation progress was slow, nor was it easy to secure unanimity of opinion or arrive at any definite decision. While the conference was in progress I frequently had occasion to reflect on how fortunate we are here in North America in having a homogeneous people. At the annual conference of our American association we are able to arrive at important decisions with comparatively few difficulties to overcome.

One resolution was adopted which had for its objective the forming of an association of "Official Seed Analysts and Seed Control Organizations of Europe." A committee consisting of Dr. Volkart of Zurich, Mr. Bruijning, Wageningen, (deceased July 21st), Mr. Dorph Peterson, of Copenhagen, was appointed to consider the constitution of the association, rules of its membership and work, and circulate their recommendations to the members of the conference. The personnel of this committee was also appointed by resolution to consider:

(a) the unification of seed testing methods in Europe, keeping in view the possibility of ultimate unification with North America;

(b) the method of expressing the results of analyses and the quality of the seeds analysed, and to present a report at the next international conference.

The matter of eligibility to membership in the European Association now formed was discussed at considerable length. In connection with the European Seed Testing Association there may be seed testing or seed control stations with full membership and others with only associate membership. At least the recommendations of Mr. Bruijning of Holland, that only seed testing stations be admitted which were fully equipped and efficiently manned with analysts having complete scientific training and experience in seed testing, seemed to meet the approval of many if not most of those present at the conference. Such fully equipped and efficiently manned stations would be admitted to full membership and thereafter the analytical certificates issued by any of the stations admitted to full membership would be regarded as a controlling factor in adjusting disputes which arise from international commerce in seeds.

Here is a fundamental question that might very well be considered by our American association. There is at least evidence from time to time that all of our seed testing stations do not command the full confidence of the interested public. If such a regulation were in effect in our association of North America some of us would have better grounds for demanding a high standard of scientific training with commensurate salaries for our supervising seed analysts.

Research—Origin of Seeds.

Dr. Volkart, of Zurich, Switzerland, has since the European Seed Control Conference of 1909 been working steadily toward the production of a basis for the

* Presidential address to Official Seed Analysts of North America, at Toronto Convention, December, 1921.

determination of the origin of certain agricultural seeds. The data which he presented at the conference was of very great interest, and when the work is completed will surely be of pronounced value to seed analysts in all countries.

Dr. Volkart submitted data from examination of a very large number of samples of grass and clover seeds obtained from America and from the principal clover seed producing districts of Europe. The presence as impurities of the seed of a few particular species of plants which were indigenous to or persistent in certain clover seed producing countries or districts, and prevalent in the seed of commerce from those countries or districts and not at all or to a very limited extent in the seed of commerce from other countries or districts, was believed by Dr. Volkart to be a reliable basis for drawing an inference as to the origin of the seed. That belief as expressed by Dr. Volkart was concurred in by all present at the conference.

I was requested in particular to bring this work to the attention of the chairman of the Research Committee and of this conference as a whole. I consider this research work to be one of great importance to agriculture. The problem has been approached before by Mr. Brown and others, but without a full measure of success .

Seed testing in Canada and the United States has now been sufficiently advanced to enable us to take up this question and give it an exhaustive study over a period of years, so that on the occasion of the 1924 conference in England we may have a fairly reliable chart of our North American seed producing territory and showing the characteristic impurities or other characteristics of many kinds of seeds produced in the different states, provinces or districts of North America.

I have given definite instructions that this matter be carefully and persistently studied in all of our seed laboratories in Canada, and I shall be very much disappointed if the chairman of our Research Committee has any cause for complaint because of want of co-operation in this matter from our Canadian seed analysts during the next few years.

We are now importing into North America large supplies of red clover seeds from Europe. There are some seed analysts connected with our association who are able to form a reliable opinion as to the country of origin. All of our seed analysts ought to be able to do that if they are to provide the protection to agriculture that they ought to provide. It is well known throughout Europe that Italian red clover seed is not winter hardy when used in the northern areas of Europe, and their seed analysts are expected to protect agriculture accordingly. Any of our seed analysts in North America who are not competent to provide that protection are not giving the service to agriculture that should be expected of them.

I have no doubt the Dr. Volkart will be pleased to place at the disposal of the seed analysts of North America the results of his ten years of study of this question. I submit that we ought to co-operate with him in that work by producing reliable information that will enable us with reasonable accuracy to determine the origin of many kinds of seeds that are grown in North America.

Methods of Analysis.

Methods of analysis and forms of reports occupied a great deal of the attention of the conference. The pros and cons of the continental system as distinguished from the Irish system of testing grass seeds can always be depended upon to occupy more time than the subject properly deserves.

It was agreed that scientifically the continental system is the correct one. On the other hand it was agreed that those countries, including England, Ireland and Scotland, which had practised the Irish system had obtained better results for agriculture and at the increased disadvantage to agriculture in those countries which practised the continental system, because while practising the Irish system in the control of the seed trade, England, Ireland and Scotland had proven to be a very unfavorable market for any grass seed that contained more than a very small percentage of chaff. Dr. Pethybridge, who is in change of seed control for the Irish Board of Agriculture, de-

clines to change to the continental method, but privately expressed the hope, in the interests of Irish agriculture, that the other countries would continue with the continental method.

Under the Irish system any seed merchant who merchandises grass seed which contains a large per cent. by number of kernelless grains is unduly penalized. In consequence the Irish imports of grass seeds are practically free from chaff. I confirmed this viewpoint of Dr. Pethybridge by consulting many of the Danish producers of Dactylis seed. I have reason to believe too that the chaff cleaned out from the orchard grass seed shipped from Denmark to Ireland is incorporated into the orchard grass seed that is shipped to other countries which apply the continental system to seed testing.

The discussions at the conference would seem to indicate that it is the members of the seed trade of Europe who insist on the continental system of testing grass seeds. The discussions developed the general view that any seed testing station on the continent of Europe which attempted to practise the Irish system of testing grass seed would soon find itself completely boycotted by the seed trade, and in consequence the revenue of the seed testing station would be seriously impaired. Dr. Pethybridge is able to continue with the Irish system because on his advice the regulations of the Board of Agriculture for Ireland require that the germination of grass seed shall be determined by his system.

This is a matter of comparatively little small importance to Canada, inasmuch as comparatively little of the seed of commerce requires for testing purposes the use of the diaphanoscope. When selling these grass seeds, however, many if not most of our Canadian seed merchants advertise only the percentage germination, much to the disadvantage of the unsuspecting buyer. Education will in time correct this evil of the seed trade, but the process of the education of seed users is very slow indeed.

Dr. Widen, of Sweden, submitted the results of quite exhaustive studies in the germination of seeds of cereals and the large seeds of leguminosae, and recommended, as a method surpassing all others as to certainty of results, the use of sand containing a quantity of water equal to about 60% of the maximum quantity that can be absorbed by the sand. Dr. Widen stated that at certain periods of the year or during certain years when the purchase of imperfectly ripened seeds may be foreseen, experiments ought to be made to ascertain whether or not the seeds are ripe and apt to germinate.

At the concluding sessions of the conference a committee memorandum was brought in and submitted and by resolution approved as to the form for reporting, as follows:

Statement to include per cent pure germinating seed, per cent hard seeds, per cent broken and dead seeds, per cent impurity. Details of impurities in a separate column to include per cent useful seeds, per cent weed seeds, per cent sand, foreign matter.

The discussion which took place on this matter seemed to indicate the view of some that this form of report would serve as a suitable compromise as between the Irish and the continental system for testing grass seed, and would serve to neutralize the disadvantage to agriculture in those countries which practised the continental system.

Fear was expressed that some of the seed testing stations might not follow this practice in reporting, and unless all stations followed this practice it was quite obvious that none of them could successfully do so unless they were supported from the fact that the law of their country required the seed to be sold under this form of statement.

Field Tests—Genuineness of Seed Stocks.

A very interesting paper was read by Mr. Dorph Peterson off Copenhagen, treating with the development in Denmark of seed testing in respect of the third and highly important quality of seeds, namely, genuineness of seed stocks. Most of the seed testing stations of North America and of Europe are in a position to make determinations only as to the percentage purity and vitality of the seeds of commerce. It cannot be disputed that the genuineness of seed stock may be on the whole of the greatest importance to

agriculture. This is a question that is deserving of careful consideration. A few years ago my chief seed inspector, Mr. E. D. Eddy, made a start at this phase of seed testing work by making arrangements with the Experimental Farms Branch of our Department to plant and produce to maturity three rows of about one hundred plants each of the different varieties of mangel, carrot, swede and turnip seeds of commerce. This work was continued for two years and with surprising results of very great importance to agriculture, and incidentally of very great importance to some Canadian seed merchants. It was not, however, to be expected that others who were not interested in the objective of that work would be disposed to carry it to a successful conclusion, which unfortunate fact, combined with unfortunate war conditions, caused the work to be temporarily suspended.

I can conceive of no work that may be undertaken by the seed analysts of North America that will gradually lead to greater efficiency on the part of seed merchants or encourage the profession of the seedman, properly so called, than this branch of seed testing work. Its value to agriculture would surely be many times the cost of providing the service.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

Important announcements concerning the Annual Convention will be made in the next issue of *Scientific Agriculture*. A resolution was passed at the Ontario Agricultural College on March 11th to the effect that the annual meetings of the C.S.T.A. should be held at agricultural colleges and that this precedent be established at once by holding the 1922 Convention at Macdonald College. The matter was immediately referred to the French-speaking members (who had invited the Convention to Montreal), to the members of the Dominion Executive and to Principal Harrison. The change has been approved and it can now be definitely stated that the Convention will not be held in the city of Montreal but at Macdonald. The principal reasons favouring the change are (1) that more adequate facilities and cheaper accomodation can be obtained and (2) that the surroundings are more attractive and more in keeping with an agriculture gathering. Montreal is only twenty miles distant and opportunity will be provided for the members and visitors to spend part of the time there.

Unfortunately the dates which have already been announced (June 20 to 23) clash with the dates of the Ormstown Fair, which is a very important event in Quebec and one which attracts many live stock men. The advisability of holding the C.S.T.A. Convention the following week (June 27 to 30) is now being considered and if any member knows of any event being held elsewhere in Canada at that time, which might interfere with the success of our own meeting, he should notify the General Secretary at once.

Tentatively, therefore, we may announce that the Second Annual Convention will be held at Macdonald College June 27 to 30 inclusive. Final announcement will be made next month.

APPLICATIONS FOR MEMBERSHIP.

G. G. Archibald (Queens, 1903, B.A.), Gardenvale, P.Q.

C. A. Lamb (British Columbia, 1921, B. S.A.) Cloverdale, B.C.

C. C. McDougall, Sussex, N.B. (Associate member).

M. P. McClellan (Ont. Vet. Coll 1900, V.S.) Regina, Sask.

LETTERS TO THE SECRETARY.

Ottawa, Ontario,
March 22, 1922.

The General Secretary,
C.S.T.A.,
Gardenvale, P. Q.

Sir,—

In response to your request contained in the latest issue of Scientific Agriculture, I beg to submit the following, relative to plans for the coming convention.

Heretofore, Provincial and Federal Departments of Agriculture have been the largest employers of Graduate Agriculturists. In view of recent public statements made by the Federal Minister and Deputy Minister of Agriculture, it would appear that, for the present at least there is not likely to be much demand for the services of this year's agricultural graduates by the Dominion department. It may be assumed, with a fair degree of certainty, that a similar situation will prevail with respect to provincial departments. We have in prospect therefore a glut of a commodity for the relief of which it has been suggested that henceforth university graduates in agriculture might very well return to the farm.

Having in mind the principal objects of a degree course in agriculture, from the standpoint of the country or the individual, I do not consider it practical or economical to conclude that ordinary individual farming enterprises should, will or can attract as a life work the majority of young men who should be graduated in agriculture. If this *laissez faire* attitude in respect of the worthy employment of agricultural graduates is allowed to prevail I believe it reasonable to suppose that agriculture will soon lose to the other professions the class of talent which has heretofore been associating itself with the degree course.

In an endeavour to promote some investigation of existing conditions and with the object of leading up to my suggestion for preliminary action, permit me to ask two questions,—

1. Is Government service the most desirable or only available medium through which to advance the profession of agriculture?

2. Will the ambitious class of farm boy who has been choosing agriculture as his profession continue to patronize the agricultural college if his only hope after graduation is to return to the farm and in many cases do as he is told, accept what remuneration he receives and practically forget what he has learned?

We have precedent enough, I think, for assuming that a university training in agriculture can be successfully capitalized in the interests of private enterprises other than farming. I venture to suppose, however, that a study of your membership lists will reveal the names of but few members who are not fully engaged in government work. I believe this condition results, to a great extent, from a want of understanding between professional agriculture and the individuals or institutions carrying on agricultural or allied enterprises other than actual farming.

Here then appears to exist the opportunity for timely liason work by the C.S.T.A. The obligation is to initiate action leading towards a wider market for the product of agricultural colleges in order to improve the demand for, thereby facilitating profitable disposal of trained agricultural services and incidentally raising the profession's standard.

I would suggest that in compiling a programme for the convention an appropriate period be reserved for presentation of our case to people representative of the commerce concerned and vice versa. The advisability of having all branches of agricultural commerce and finance represented at our convention goes without saying.

Yours very truly,
P. Stewart.

BRITISH COLUMBIA BRANCH.

For the information of C.S.T.A. members and particularly those who are responsible for the activity of local branches, we have reproduced on pages 281 and 282 the programme which has been arranged for the Annual Convention of the British Columbia Branch. The local executive is to be congratulated for the work they have done in drawing up such an excellent series of addresses and discussions.

Some of the resolutions which are being introduced at this meeting and which, if approved, will be presented at the General Convention in June, will provoke considerable discussion. These resolutions will be published in the next issue of *Scientific Agriculture* so that all members may have an opportunity of considering them.

Other branches of the Society may well take a lesson from their fellow-members in British Columbia.

Eastern Ontario Branch.

On Monday, February 27th, this branch gave a banquet at the Chateau Laurier, Ottawa, at which the guest of honour and principal speaker was the Hon. W. R. Motherwell, Minister of Agriculture. Other speakers were Dr. J. H. Grisdale, Deputy Minister and Mr. W. J. Bell, Principal of the Agricultural School at Kemptville. About fifty members were present.

The annual business meeting was held on Friday, March 24th.

NOTES.

Wade Toole (O.A.C. '11), Professor of Animal Husbandry at the Ontario Agricultural College, is taking post graduate work at the Iowa State College.

Arthur Lamarre (Laval '20), has been transferred from Drummondville to Laprairie, P.Q., as District Agriculturist (Agronome).

John Tothill (O.A.C. '10), Officer in Charge of the Dominion Entomological Laboratory at Fredericton, N.B., has recently been granted the degree of Doctor of Science by Harvard University.

Justus R. Miller (O.A.C. '14), is now in the employ of the Ontario Department of Agriculture as Agricultural Representative for Essex County. His address is Essex, Ont.

C. F. Bailey (O.A.C. '09), has resigned as Managing Director of the Royal Agricultural Winter Fair. His immediate plans are not yet announced but a rumour is abroad that he will soon be with the Dominion Department of Agriculture.

The death occurred at Guelph on Saturday, February 25th, of Cecil R. Klinck (O.A.C. '06), Specialist in Plant Breeding at the Ontario Agricultural College. Mr. Klinck, who was a brother of President L. S. Klinck of the University of British Columbia, had been in poor health for some years, but his death was entirely unexpected. He was working actively until a few days before he died.

A memorial service was held at the Disciples' Church, Guelph, on Sunday, February 26th, and burial took place at Stouffville, Ontario, on the 28th.

SECOND ANNUAL CONVENTION OF THE BRITISH COLUMBIA BRANCH.

Vancouver, April 4 and 5, 1922.

... PROGRAMME

Tuesday, April 4

Morning Session—9.30 a.m.

Presidential Address.

Minutes.

Business arising out of the Minutes.

Correspondence.

Report of the Secretary-Treasurer.

Report of the Committee on Agricultural Policies.

11 a.m.

Address—"The Environment for Research"

By L.S. Klinck, M.S.A. D.Sc., President of the University of British Columbia and President of the Canadian Society of Technical Agriculturists.

Discussions.

Afternoon Session—2 p.m.

Appointment of Committees on:—

Nominations.

Resolutions.

2.30 p.m.—RESEARCH PROBLEMS IN AGRICULTURE

Section A.

Applied Genetics or Breeding Problems

as related to:

ANIMAL HUSBANDRY—W. H. Hicks, B.S.A., Superintendent of Experimental Farm, Agassiz.
Discussion led by Prof. H. M. King, B.S.A., University of British Columbia.

AGRONOMY—Professor G. G. Moe, B.S.A., M.Sc., University of British Columbia.
Discussion led by R. H. Helmer, Superintendent of Experimental Farm, Summerland.

HORTICULTURE—Professor F. E. Buck, B.S.A., University of British Columbia.

POULTRY—Professor V. S. Asmundsen, M.S.A., University of British Columbia.

5.30—Adjournment for Supper

Evening Session—7.30 p.m.

Section B.

Economic Field Problems in Agriculture

as related to:

FRUIT GROWING—W. H. Robertson, B.S.A., Povincial Horticulturist, Department of Agriculture, Victoria.

DAIRY PRODUCTION AND MANUFACTURE—H. Rive, B.S.A., Provincial Dairy Commissioner, Department of Agriculture, Victoria.

SOIL SURVEYS—W. Newton, B.S.A., M.Sc., Chief Soil and Crop Instructor, Department of Agriculture, Victoria.

ANIMAL DISEASES—E. A. Bruce, D. V.Sc., Pathologist, Dominion Experimental Farm, Agassiz.

*POULTRY SURVEYS—R. J. Skelton, B. S. A., Field Enumerator, University of British Columbia.

*This paper may be presented under Section A.

Wednesday, April 5
9.30 a.m.

Section C

Bio-chemical Problems in Agriculture..

as related to:

SOILS—Professor P. A. Boving, Cand. Phil.; Cand. Agr. Alnarp, University of British Columbia.
Discussion led by D. G. Laird, B.S.A., University of British Columbia.

INSECTICIDES AND FUNGICIDES—J. W. Eastham, B.Sc., Provincial Plant Pathologist, and R. C. Treherne, B.S. A., Chief of the Division of Field Crops and Garden Insects, Ottawa.

TREE AND SMALL FRUITS—Professor A. F. Barss, A.B., B.S. in Agr., M.S., University of British Columbia.

MEDICINAL PLANTS—Professor R. H. Clark, M.A., Ph.D., University of British Columbia, and J. Davidson, F.L.S., F.B.S.E., University of British Columbia.

FOODS—W. H. Hill, B.S.A. Federal Department of Health, Vancouver.

DAIRY BACTERIOLOGY—Miss M. J. Mounce, B.A., B.S.A., University of British Columbia, and Professor W. Sadler, B.S.A., M.Sc., University of British Columbia.

4 p.m.

Business Session.
Reports of Committees.

6.30 p.m.

Dinner at the University Club

Guest—Hon. E. D. Barrow, Minister of Agriculture, Victoria.

Speakers for the Evening:

Geo. Hay, B.S.A., District Agriculturist for the Provincial Department of Agriculture.
"Stock Raising Problems of the Interior Sections of British Columbia."

R. L. Ramsay, B.S.A., District Agriculturist for Soldier Settlement Board.
"Observations on Soldier Settlement in the Fraser Valley."

Dean F. M. Clement, B.S.A. University of British Columbia.
"An Introduction to Some Problems in Agricultural Economics."

Milling Quality of Saskatchewan Wheat

By Manley Champlin & Cyril H. Goulden
Field Husbandry Department, University of Saskatchewan

Introduction

The ordinary characteristics of wheat varieties such as yield, time of maturity, height, and others of a similar nature are more or less obvious to the observing farmer, and it is on the basis of these obvious characteristics that the large majority of farmers arrive at their conclusions as to the value of the different varieties for their particular conditions. These varieties, however, differ considerably with regard to the actual value or "quality" of the wheat grain which they produce, and this actual value can only be arrived at with some degree of accuracy by means of a milling and baking test. It is not at all apparent from the plant characters of the variety and only to a slight extent from the appearance of the threshed sample of wheat grain.

For the past eight years the University Field Husbandry Department has been carrying on field tests with the leading varieties of wheat and each year samples of these wheats have been sent to some reliable wheat testing laboratory in order to have their milling and baking values determined. The data which has been gathered from these tests is now available for publication and it is our purpose in the following discussion to set forth the information gathered from this data in such a manner that anyone making a study of wheat varieties may be able to come to some conclusions with regard to their relative actual values or quality. The need for some tabulated information of this kind becomes evident from the fact that quality in wheat comes next in importance to yield and time of maturity, and yet it can only be ascertained by means of milling and baking tests.

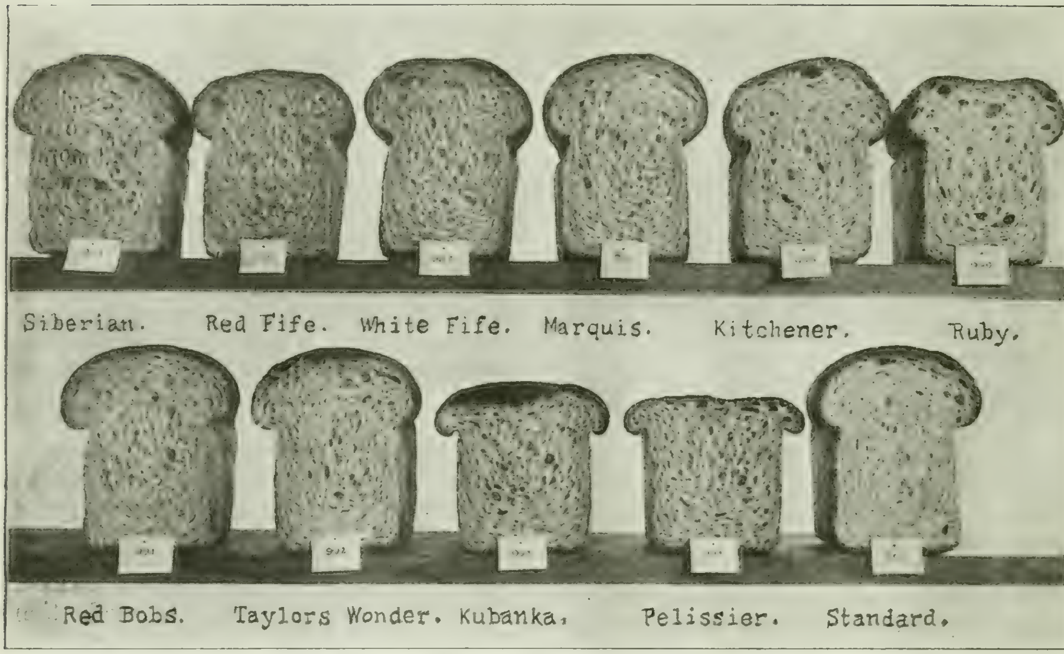
Among practical wheat growers, the question often arises as to why they should consider the quality of their wheat as of any importance when very often they can make just as great and sometimes a greater profit from the growing of a poor quality wheat. In this connection it must be remembered that the bulk of the wheat sold from Saskatchewan farms, comes from varieties that are high in quality. This, together with the fact that our climate is very favorable for the growing of high quality wheat has built up for us in the markets of the world, a reputation for the production of wheat of this kind. For these reasons there is usually a greater demand for our wheat and it is this demand which keeps up the price of the low quality wheats. It is quite possible for an individual farmer or even the farmers of a district to make a considerable profit from the production of low quality wheat, but no sooner is this wheat grown to any extent than it becomes noticeable on the wheat markets and consequently there is a "cut" in the price. When we buy goods ourselvees, we expect the price to vary with the quality and we look with disdain upon the dealer who attempts to foist upon us poor quality goods at regular prices. It is to be expected then that those who buy our goods should regard the situation from the same standpoint.

Important Factors in the Consideration of Wheat Quality

Usually, the term "quality" as applied to wheat grain has a more or less varied meaning. The reason for this may be easily understood from a consideration of the fact that the grain may be used for more than one purpose and that its value or quality depends to a very large extent on the particular purpose for which it is intended. The miller who wishes to produce high grade semolina for the manufacture of macaroni, desires a wheat which is high in gluten and will produce a hard granular flour. The miller intent upon the production of pastry or cracker flour desires a wheat which is low in protein and proportionately high in starch. In either of these cases the millers speak of the wheat as of high quality which is best suited for the manufacture of the product desired.

The investigations reported in this discussion were begun under the direction of John Bracken and have been continued under the direction of Manley Champlin. During the entire period covered, the details of production were carried out by Robert Stewart. Much of the value of this work has been due to the extreme care with which he maintained the purity of the varieties under trial.

The following instructors have been in charge of the scientific details of the work here reported at different times, — A. W. Henry, J. B. Harrington and C. H. Goulden.



Loaves from the Standard Varieties of the 1918 Crop.
(Note the sunken top of the Ruby loaf and that the loaves from the durum wheats are lacking in volume.)

The greater part of Saskatchewan wheat, however, is used for the manufacture of bread flour. Therefore, in this case, quality in wheat is indicated by its suitability for the manufacture of bread flour and by the characteristics of this flour which determine its suitability for the making of bread. In other words, we must consider both the milling quality of the wheat and the baking quality of the flour.

Milling Quality

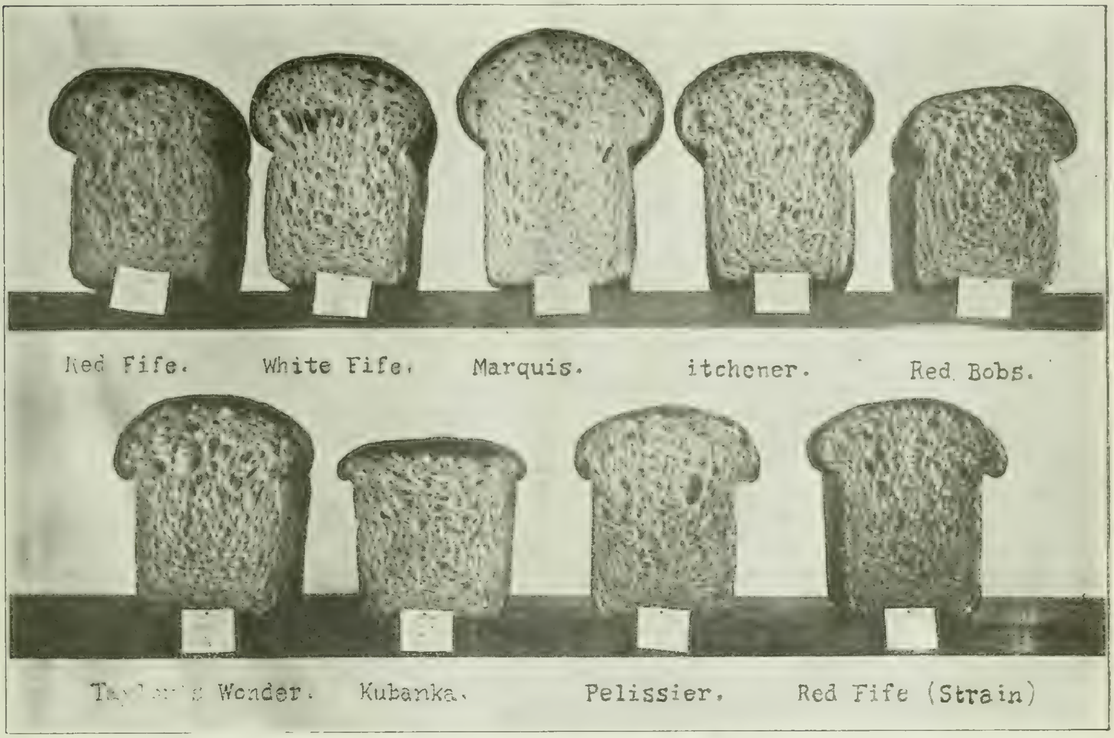
The milling quality of a wheat as determined by the milling test depends chiefly upon two factors: first, the yield of flour, and second, the color of the flour. These two factors are more or less correlated. By removing all possible flour from the bran the miller is able to obtain the greatest yield, but this is usually detrimental to the color. Again, by milling the wheat so as to obtain flour of the best possible color, the yield is proportionately lowered. The miller must therefore balance these two factors, the quantitative factor of flour yield and the qualitative factor of flour color, so as to give him the greatest net returns. The particular wheat which may be milled so as to keep both of these factors high is considered to be of high milling quality.

The yield of flour as determined by the milling test is expressed in percent of the wheat milled and the color of the flour described or scored. The importance of flour color is due to the consumer's consistent demand for white bread. In general the best flour should be almost white with a faint creamy tinge.

Baking Quality

The baking quality of a flour is indicated chiefly by the elasticity of the gluten, the volume of the loaf, the texture of the loaf, and by the water absorption.

The elasticity of the gluten and loaf volume may best be considered together as it is upon the elastic properties of the moist gluten in the dough that the volume of the loaf is dependent. As the yeast organism acts upon the starch of the flour carbon-dioxide and alcohol are given off. The mass of dough then becomes filled with innumerable tiny cavities which expand further and further as the volume of the gas increases. Finally, if the loaf is not heated to a baking temperature, the elastic walls of the cavities become distended to the limit and burst, and the mass of dough begins falling back to its former volume. In the process of bread making the dough is placed in the oven before it reaches this stage. The walls of the cavities then become stiffened



Loaves from the Standard Varieties of the 1919 Crop.
(Note the superior quality of the Marquis loaf.)

through coagulation, the yeast organism is killed, preventing further action, and the gases driven off through the pores of the bread. It is the gluten of the flour which gives the walls of the cavities their elastic properties and also prevents the gas from escaping through them. Obviously then, the volume to which the loaf will expand depends upon the elasticity of the gluten. In general, the loaf volume as determined by the baking test, refers to the ability of the loaf to expand, to hold up well, and to give a light well-piled loaf.

The texture of the loaf is an important consideration but it is much more difficult to express than loaf volume. It includes such items as uniformity of the cavities, size and evenness of distribution, and thinness and transparency of the cavity walls.

In the mixing of the dough for baking, water is added until the dough has reached the proper consistency. The amount of water used will vary to a considerable extent with the different flours. This is spoken of as the absorption capacity. It is of considerable importance to the baker as the greater the absorption the greater will be the yield of bread per barrel of flour. The weight of the loaf after baking is also important from the baker's standpoint as it shows the ability of the flour to retain the absorbed water and thus increase the yield of bread.

Tests of Varieties

In tables I to VIII will be found the results of the milling and baking tests for the years 1913 to 1920 inclusive. During the first four years (1913 to 1916) the tests were made by the Howard Mills, Minneapolis. These tests were entirely satisfactory, but at the end of this time it was thought desirable that the tests be made in Canada if possible. The milling and baking tests from 1917 to 1919 were made by Dr. F.J. Birchard, in charge of the Dominion Grain Research Laboratory, Winnipeg, in 1920 the tests were made by Mr. R. Sneddon, Analytical Chemist, 611 Notre Dame Investment Building, Winnipeg.

The tabulated results of the tests as supplied by the Howard Mills and by Birchard and Sneddon, although essentially the same, are presented in somewhat different form. Both kinds of tables require some explanation.

In the Howard tables the results have

Loaves from Some of the Poorer Varieties of the 1920 Crop.

been collected under three main headings; flour, gluten, and loaf. Under "flour" the yield is given in percent and the color of the flour described. The abbreviations used for describing flour color are as follows:—wh. white; cr. creamy; L. a little; and G. grey. Under "gluten" the percent dry crude gluten in the flour is given in figures and the quality of the gluten described. The abbreviations used in describing gluten quality are: F. fairly; and E. elastic. Under "loaf" the volume of the loaf is given in cubic inches, the weight of the loaf in ounces, the water used (indicating absorption capacity) in ounces, and the shape and texture described in terms. Usually the shape and texture are "normal" and this is sometimes abbreviated to N.

Another column given in the table is headed "Relative Value". This is obtained as stated in the Howard Milling Test Reports by the Howard Value Scoring for hard wheats. Number 2 Northern is taken as the basis and a price of $1.00 per bushel assumed. **This scoring system is never offered as evidence by which the buyer or seller must abide for it must be understood that the score represents the present comparative intrinsic value of the particular sample of wheat scored, unmixed, for milling and bread making purposes. In this regard it would be well to point out that the value of our wheat depends primarily upon the fact that it is in great demand for blending with weaker wheats.** Under these circumstances, therefore, it appears that the relative value as determined by the Howard Scoring System is based on a wrong assumption, at least as fas as our wheats are concerned.

The Birchard tables require very little explanation. The water absorption is given in percent of the weight of flour used in the test (340 grams). Loaf volume is expressed in cubic centimeters and is measured by the number of cubic centimeters of turnip seed displaced by the loaf when placed in a box of known volume. Shape denotes the ratio between the height of the loaf above the pan and the extreme width. It is thus correlated with loaf volume. Cylinder volume (made use of in only one table) is the measurement of the number of cubic centimeters to which one-sixth of the weight of the dough will expand before dropping. Loaf volume, shape, and cylinder volume are considered to be measures of the strength of the flour. Color, texture, and general appearance are expressed by a score according to a standard which is scored 100 for each of these qualities.

In each of these tables, some attempt has been made by the authors to arrange the varieties in order according to their performances for that year. In the case of the Howard tables they have been arranged according to their relative values but as stated above it must not be understood that this is considered a perfectly reliable and absolute measure of their relative milling and baking qualities. Furthermore, it will be noted that in some cases the relative values appear to lack justification. Thus in Table IV, comparing Kitchener with Red Bobs, the yield of flour is the same within the experimental error, the amount of gluten, color of flour, and loaf volume the same, the weight of loaf and water used in favor of Red Bobs, the shape and texture are the same, and yet Red Bobs according to the relative values is worth three cents less per bushel. For this reason it is highly recommended that anyone wishing to become closely acquainted with the results, make a careful study of the different elements of each

column in the tables and come to their own conclusion is to the relative milling value and baking qualities of the wheats tested.

In the Birchard tables no flour yields have been reported. This is due to the fact that only five pound samples were sent to be tested and it is considered impossible to obtain accurate results on an experimental mill, without duplicating the tests many times.

In these tables the wheats have been arranged according to their baking qualities as near as can be estimated. Again it must be understood that the arrangement is not considered final and absolutely correct. We are entirely open to criticism in this respect and hope that those who study the tables will pay due regard to each item and come to their own conclusions with regard to the relative performance of the different wheats.

In a comparison of yields of varieties it is always found advisable to average the yields for a number of years in order to obtain accurate results. It was at first thought that it would be possible to average our milling and baking test data in much the same manner and thus prepare summary tables which would indicate the actual milling and baking values of the different wheats very accurately. On further consideration, however, it was found that this method would be more or less impracticable and would be likely to introduce several inaccuracies. The reasons for this may be set down as follows:

1.—Much important data on both kinds of tables are given in legends and not in figures. This sort of data could not be averaged, and of omitted, the milling and baking qualities of the wheats under consideration would not be truly represented.

2. The data from the two sources are presented in very different form. The tables are thus not truly comparable and at the most only four year averages could be obtained.

3. Texture, color, and shape in the very poor quality wheats are not given a score and accurate results could not be obtained if they were omitted.

4. To possess high milling and baking quality a wheat must be good in every particular and consistently so. Certain varieties go very low one year and high in another. Certain other varieties during some years will drop very low in one point and in another point during other years. In both of these, averaging brings the wheat up closer to normal and erroneous results are obtained.

To conclude: the summarizing of milling and baking test data is not usually practicable; therefore, the only satisfactory way to arrive at conclusion with regard to the relative milling and baking values of the different varieties is by a careful perusal of the results by years, following out closely the showing made by each variety each year.

Having carried out this program we have found than it is practically impossible to arrange the varieties definitely in order according to their milling and baking values. They can, however, be quite conveniently arranged in different groups, each group having in common some particular qualities which distinguish it from the rest.

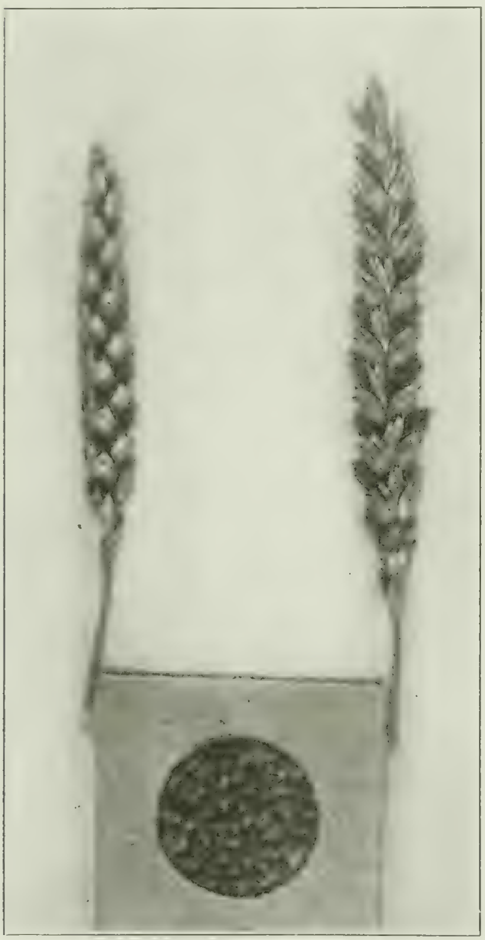
We now propose to set down these groups in order and discuss the milling and baking values of the varieties which compose them.

Group 1.—Marquis, Red Fife, Kitchener, Red Bobs.

In long continued tests Marquis has proven itself to be a wheat of excellent milling quality. During the first three years that the tests were carried on it appeared to be slightly inferior to White Bobs, a white wheat, and it is to be regretted that the tests on the latter were discontinued from that time on. In other years Marquis has headed the list in the majority of cases and has always been very close to the top. Its excellent performance is due in great measure to the consistency with which it gives results.

Red Fife wheat has been tested along with Marquis for a period of eight years. In two cases 1914 (Table II) and 1917 (Table V) it was slightly superior to Marquis but in neither case was the difference marked. In other years it has fallen below Marquis and in some years has given rather low tests. There is no question, however, as to its being a good milling wheat, the poor tests probably being due to the nature of the samples themselves. In 1916 (Table IV) the loaf

volume was rather low. In 1918 and 1919 (Tables VI and VII) it dropped slightly in loaf volume and considerably in color and texture. These results with regard to the relative milling and baking qualities of Marquis and Red Fife wheat are completely in accord with those reported by other investigators. Ball and Clark (1)* make the following statement in this respect, "Numerous milling tests show that Marquis is equal or slightly superior to similar samples of Fife and Bluestem wheats". Sanderson (2) of North Dakota and Arny and Bailey (3) of Minnesota report similar results. Birchard (4) arrives at the following conclusions from a large number of tests. "These tests failed to establish any marked difference in the milling and baking values between Marquis and Red Fife wheat. The very slight differences found, however, were in favor of Marquis wheat, but it should be noted that the general quality of the Marquis samples as graded by the inspector was slightly better than that of Red Fife, and it is believed that this would account for the slight differences in quality obtained." These tests were made on the 1915-16 crop.



GROUP I — Marquis
A wheat of excellent milling quality.

GROUP I
Kitchener Red Fife Red Bobs
Wheats of excellent milling quality.

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* (1) Marquis wheat—C. R. Ball and J. A. Clark, U. S. Department of Agriculture, Washington, D. C., Farmers' Bulletin No. 732.

(2) Milling and Baking Test Results of Marquis vs. Bluestem and Fife wheats—T. Sanderson, North Dakota Agricultural Experiment Station, Special Bulletin, Volume 2, No. 22, Food Department.

(3) Marquis Wheat—A. C. Arny and C. H. Bailey, Minnesota Agricultural Experiment Station, Bulletin No. 137.

(4) Report of the Dominion Grain Research Laboratory, Winnipeg, Man., 1920 — submitted by F. J. Birchard, Chemist.

The remaining members of this group are undoubtedly high quality wheats. They were first tested in 1915 and since then have been continued in the tests each year.

In 1915 (Table III) Red Bobs stood highest as regards relative value but this is due chiefly, as will be seen by an inspection of the table, to the exceptionally high flour yield which it gave in that test. It fell slightly below Marquis in loaf volume but was superior in amount of gluten, weight of loaf, and absorption. In 1916 (Table IV) as compared with Marquis, Red Bobs was somewhat lacking in loaf volume but was higher than Red Fife in the same test. The flour was a "little" grey but this may easily have been due, either to damage to the sample (frost or immaturity) or to its being slightly over milled. In 1917, 1918 and 1920, this wheat gave very good tests but in 1919 (Table VII) it fell unusually low. Marquis was the only wheat from the 1919 crop which gave a really satisfactory test. The samples from this crop were of a peculiar nature, due probably to climatic conditions; therefore, to much importance should not be attached to the results obtained.

The first test made on Kitchener, 1915, indicated it to be almost if not quite equal to Marquis. In 1916 (Table IV) it fell below Marquis in loaf volume but was higher than Red Fife and equal to Red Bobs. In 1917 it was about equal to Marquis in loaf volume and was superior in texture of loaf. The flour was slightly dark in color but this may easily be accounted for by its having been slightly over-milled. Practically all the tests on the samples for that year were satisfactory. In 1920 Kitchener excelled and we now consider it as one of our best milling wheats.

Group II.—White Bobs, White Fife, Taylor's Wonder.

This group is represented by those varieties which are commonly known as white wheats. The white color is in most cases entirely due to a lack of red pigment in the bran and bears no relation whatever to the composition of the interior of the kernel. Some of these wheats, however, such as Taylor's Wonder, are not only white in color of bran, but the interior of the kernel is of a starchy nature, lacking in the translucent, glutinous characteristics of most of our high quality wheats. Wheats of this nature are usually called "soft wheats" and the kernel is much easier to crush than those of the "hard" types. White Bobs and White Fife are not at all starchy in appearance and cannot be classed with the soft wheats.

The necessity of this explanation arises from the fact that the soft wheats usually yield a flour which is somewhat lacking in baking strength, and such white wheats as White Bobs and White Fife are often confused with them. As a result, there has arisen a decided prejudice against white wheats regardless of their actual milling and baking value. That such should not be the case is plainly evident from the tests on White Bobs. It is evidently as high in quality as any of

GROUP II

White Bobs White Fife Taylor's Wonder
The first two of these are white wheats but are of excellent milling quality. Taylor's Wonder is a starchy wheat and yields a flour which is lower in baking strength.

GROUP III

Preston Pioneer Prelude

Wheats of very fair milling quality.

our so-called hard red wheats. Even Taylor's Wonder, a fairly typical soft wheat, has given good results. Practically its only failing has been a slight coarseness of texture. White Fife has been tested for six years (1914 to 1919) and it has proven it self at least equal to Red Fife. During the last three years it has been superior.

Group III. — Prelude, Pioneer, Preston, Chelsea.

Certain wheats seem to fall naturally into this group. They are distinguished as wheats of fair milling quality as they have never given really high tests.

Prelude was tested in 1914, 1915 and 1919. In the first two cases it gave fair tests and in the last a fairly poor test, in common with most of the other varieties.

GROUP IV
Ruby Stanley

GROUP V
Alaska Club

Ruby has given good tests at Ottawa but the milling quality of the western grown grain is still in doubt.
Alaska and Club are undoubtedly of very poor milling quality.

Pioneer was tested in 1915 and 1916, and again in 1919. It gave very similar results to Prelude. One test of the Chelsea indicated that it should class with Pioneer and Prelude, apparently not differing materially from them. No results are available on Saskatchewan gown Preston but farther south where it was formerly grown extensively under the name "Velvet Chaff" it has always been considered a fairly good milling wheat but not equal to Marquis or Red Fife.

Group IV.—Ruby.

Only one wheat can at the present time be classed in this group. It has been tested for only two years, 1918 and 1920, but in both cases the results have been unsatisfactory. In 1918 (Table VI) it was the poorest of all the bread wheats, the flour being weak and the general quality of the loaf only fair. In 1920 (Table VIII) it gave a good loaf of fair texture but the color was decidedly grey. This may have been due to over-milling. From our results to date it appears that Ruby is not consistently a good milling wheat. Further tests, however, will be necessary in order to reveal its true quality.

The work of other investigators along this line will be looked for with interest as it now appears that Ruby is a very promising early wheat for some of the northern districts of the province. The whole problem of milling and baking quality of Ruby wheat is therefore of great importance to us and must be given a very thorough investigation.

Group V.—Club . Redstone. Alaska. Kinley. Stanley.

We now come to a group of wheats of which it can be said that the milling and baking quality is undoubtedly poor. The purpose of this discussion will have been amply fulfilled if the wheat growers

of Saskatchewan are warned in regard to the quality of these wheats.

Club is usually a soft starchy wheat but many of the samples grown in Saskatchewan and Manitoba are bright red and very attractive in appearance. It was first introduced to northern Manitoba where it was grown for a time as Kidd wheat, after the farmer who had introduced it. Since then it has spread considerably and in many places has extended over into Saskatchewan.

Dr. C. E. Saunders (*) carried on milling tests with this wheat as early as 1905, and came to the conclusion that the flour was very deficient in quality of gluten, lacking in strength and of a very dark, unattractive yellow color. Only one test has been made of Club wheat grown at this station (1915, Table III) but the results showed it to be so conclusively poor that further testing was unnecessary.

Alaska wheat has probably the most interesting and varied history of these poor quality wheats. It possesses a large branched head which gives it the appearance of a very high producer and this characteristic has again and again been made use of by unscrupulous dealers to foist it upon the unsuspecting farmer at exorbitant prices. This periodic exploitation of the farmer has been continually taking place ever since the introduction of this wheat to the New England States over one hundred years ago. Needless to say the buyers have been sadly disappointed not only in the yield but in the poor quality of the wheat.

Samples of Alaska wheat grown at Saskatoon were tested during three successive years, 1914, 1915 and 1916. A glance at Tables II, III and IV will reveal the results. In every case it has proven the poorest variety of wheat tested. The quality of the gluten was very poor, the flour extremely weak, and the shape of the loaf entirely bad. Investigations carried on by the U. S. Department of Agriculture indicate similar results. (*)

Redstone wheat resulted from a cross between Ladoga and Red Fife. In 1919 a special test was made of this wheat, the results from which are given at the foot of Table IV. In this case it was found to be worth only 82.3 percent of the Normal No. 2. In 1920, Table VIII, it again gave a very poor test.

Although no samples of Stanley wheat grown at this station have been tested for milling quality, this wheat was discarded by most experiment stations on account of the low tests which it gave. Dr. C. E. Saunders (**) calculates from his milling test results a figure which is intended to represent the relative baking strengths of the flours used. By this method Marquis shows an average baking strength of 93 and Stanley an average baking strength of 85. These results place it in the medium class (Group III) but we have chosen to place it in Group V because the conclusions which led to its being discarded were based almost entirely on its milling quality.

Kinley wheat has only been tested for one year (1920) but, as will be seen from an inspection of Table VIII, the results indicated it to be so poor that it is practically out of consideration as a good milling wheat.

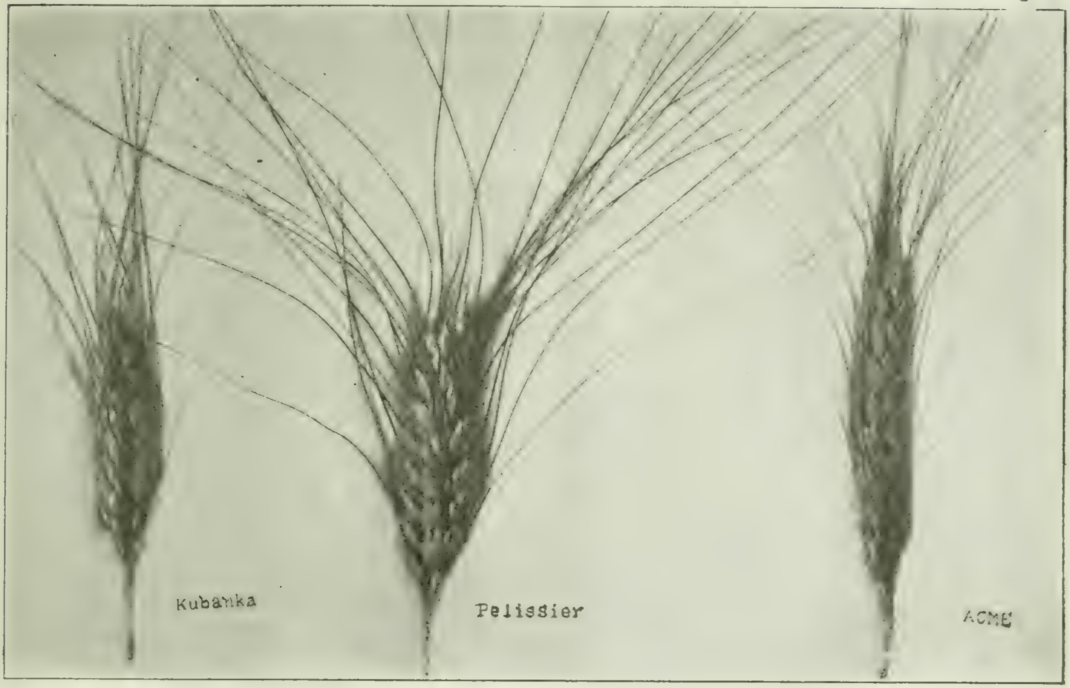
Group VI.—Kubanka. Acme. Pelissier. Monad. Other Varieties of Amber Durum.

These varieties of wheat are adapted to production in regions having a warm, dry maturing period, that is, the time from heading to ripening. In districts or in seasons having damp cloudy weather dur-

* Evidence of Dr. Charles E. Saunders, Cerealist, Dominion Experimental Farm, before the Select Standing Committee on Agriculture and Colonization, 1905.

* Ball, Carleton R., and Leighty, C. E. Alaska and Stoner or "Miracle" wheats, Two Varieties Much Misrepresented. U.S. Department of Agriculture Bulletin No. 357, 1916.

**Saunders, C. E. Wheat Bread and Flour, Bulletin No. 97, Dominion Experimental Farms.



GROUP VI

Kubanka Pelissier Acme

Durum Wheat.

Used chiefly for the manufacture of macaroni and for blending with common wheat **for bread flour.**

Loaves from Some of the Strains of Red Bobs, 1913 Crop. Also One Strain of Marquis.

ing this period, this class of wheat is unsuccessful due to development of scab, black end and other diseases and to the formation of an excess of starch in the kernels.

Kubanka and Pelissier are direct introductions from Russia. Acme was developed at the Highmore South Dakota Experiment Farm, and was first distributed in 1917.

Monad was developed at the Fargo, North Dakota Experiment Station. Acme is a selection from Kubanka C. I. 1516. Monad is a selection from an un-named lot of Russian wheat, probably of the Arnautka variety. Both Acme and Monad are therefore pedigreed amber durum varieties and have proved to be superior in yield, drouth resistance, and rust resistance, being practically free from rust in Dakota. Both Acme and Monad have weak straw and are therefore not suitable for the strongest soils. Recent tests by the Pillsbury Milling Co. of Minneapolis indicate that the color of Acme and Monad flour is not as good as that of the original Kubanka for macaroni manufacture. Standard milling and baking tests of Acme in comparison with other amber durum varieties covering a long period of years are reported in South Dakota Bulletin 194. These tests failed to show any inferiority in quality in Acme as compared with Kubanka, but in view of the fact that Acme and Monad lodge more readily on rich soils than Kubanka and that color tests on the 1921 crop have proved inferior to Kubanka, it is recommended that Saskatchewan farmers grow Kubanka rather than the newer selections if for any reason they wish to grow durum wheat. Durum wheat flour is used primarily for the manufacture of semolina flour for making macaroni, spaghetti and similar products, but it is also said to be used for blending with bread wheat flour at the rate of from 25 to 35 percent durum flour to 65 or 75 percent bread wheat flour.

Kubanka is generally recognized as the best milling variety of durum wheat and is more generally grown in North America than all other varieties combined. Data comparing this variety with our standard sorts of bread wheat will be found in several of the tables. Its flour color is creamy yellow and its yield of flour is excellent, but the loaf volume is less than that of Marquis. Kubanka bread is pleasant to the taste and of light food value, but it is not as light nor as white as bread made from Marquis wheat. Hence, under present market demands, it must be considered in a class by itself, its chief uses being for manufacture of macaroni, spaghetti, puffed wheat, and for blending purposes. Since durum wheat is extra hard and brittle, special adjustments of the milling machinery are necessary. As a result, mills grinding durum wheat frequently specialize in it.

Unfortunately, much of the durum wheat has become mixed with bread wheat due to growing the two types in the same district. This gives a product which is neither durum nor bread wheat and is inferior from the miller's point of view. Since durum wheat growing is new in Saskatchewan it is urged that it be confined to the districts where bread wheat fails or makes a short crop due to drouth and that those beginning with it "make haste slowly" and insist on having pure seed to start with. By so doing, the Saskatchewan grown durum wheat can be maintained as a superior product, which will eventually find a special demand on the market by large concerns that specialize in the manufacture of durum wheat products.

Group VII.—Red Durum (D5)

This is an unnamed variety that occurred in some of the bulk shipments of amber durum wheat when imported from Russia. The grain is hard, bright and vitreous. It appears to be of excellent quality but unfortunately its appearance is deceiving. The grain can be easily distinguished from the several bread wheat varieties by the fact that it has no brush.

The strain known as D5 was developed at the North Dakota Agricultural College and distributed in a limited way for trial by farmers because of its practical immunity to stem rust of wheat (*puccinia graminis*). Its appearance in field and treshed sample was so pleasing that it was rapidly increased and spread widely over North Dakota and into certain localities in South Dakota. It rapidly became mixed with other wheats grown in the same localities, through custom threshing,

Table I. Milling and Baking Tests, 1913.

Variety Name	Flour Yield Percent.	Flour Color.	Gluten Percent Dry Crude.	Gluten Quality.	Loaf Volume cu.in.	Loaf Wt.oz.	Loaf Water used oz.	Loaf Shape & texture.	Relative value
White Bobs	75.8	Cr.wh.dull	12.6	Elastic	198	18.31	7.63	normal	$1.05
Marquis	75.7	Cr.wh.dull.	13.6	Elastic	191	18.69	8.00	normal	1.04
Red Fife	76.2	Cr.wh.L.grey	13.8	Soft,elastic	163	18.75	7.94	normal	0.95
Kubanka	75.7	Cr.wh.dull	14.2	Soft,F.elastic	158	18.75	8.06	normal	0.94
Minnesota	74.7	Cr.wh.L.grey	12.4	Soft,F.elastic	150	18.69	7.81	normal	0.86
Marquis	75.4	Cr.wh.L.dull	13.2	Elastic	205	17.88	7.19	normal	1.05
*Red Fife	75.8	Cr.wh.L.dull	12.0	Elastic	186	18.13	7.44	normal	1.02
Average Normal	74.0	Cr.wh.dull	11.4	Elastic	200	17.63	6.94	normal	1.00

*Second test made of these two owing to unusually poor showing made by Red Fife in the first.

Table II. Milling and Baking Tests, 1914 Crop.

Variety name.	Flour Yield Percent.	Flour Color.	Gluten Percent Dry Crude	Gluten Quality.	Loaf Volume cu.in.	Loaf Wt.oz.	Loaf Water used oz.	Loaf Shape & Texture.	Relative value.
White Bobs	75.0	Wh.cr.L.dull	14.0	Elastic.	203	18.06	7.31	Normal	$1.09
Red Fife	73.6	Cr.wh.L.dull	14.4	Elastic	206	17.81	7.19	Normal	1.08
Marquis	74.7	Cr.wh.L.grey	14.2	Elastic	203	18.13	7.44	Normal	1.08
Taylors Wonder	74.7	Wh.L.dull.	10.2	Elastic	203	17.75	7.13	Normal	1.06
Chelsea	74.4	Wh.cr.L.dull	12.8	Elastic	194	18.00	7.38	Normal	1.06
*Kharkov	74.8	Cr.wh.L.grey	14.0	Soft, elastic.	187	18.06	7.31	Norm.	1.06
White Fife	72.9	Cr.wh.L.dull	14.8	Elastic	198	17.50	6.75	Normal	1.02
* Swan River	74.8	Wh.cr.L.dull	14.4	Soft,F.elastic.	166	18.25	7.56	Normal	1.02
Prelude	74.5	Cr.wh.dull.	17.2	Elastic	189	17.88	7.00	Normal	1.01
* Buffums #17.	75.0	Cr.wh.L.dull	14.2	Soft,F.elastic.	174	17.31	6.63	Normal	1.00
Kubanka	74.0	Yellow. wh.	15.0	Soft,F.elastic	170	18.19	7.38	Poor	0.99
Alaska	72.7	Yellow.wh.	13.8	Soft.non-elastic	110.	18.50	7.75	Poor	0.81
Average Normal	72.0	Cr.wh.dull	11.4	Elastic	202	17.44	6.88	Normal	1.00

* Winter Wheats

Table III. Milling and Baking Tests, 1915 Crop.

Variety Name.	Flour		Gluten		Loaf				Relative value.
	Yield Percent.	Color.	Percent dry Crude.	Quality.	Volume cu.in.	Wt.oz.	Water used oz.	Shape & Texture	
Red Bobs	77.6	Wh.cr.dull	15.8	Rather Soft, elastic	196	17.94	7.25	Normal	1.14
Marquis	73.8	Wh.cr.dull	14.6	Elastic	204	17.69	7.13	Normal	1.11
Kitchener	77.0	Cr.wh.L.dull	13.8	Elastic	184	18.00	7.25	Normal	1.11
White Bobs	77.2	Cr.wh.L.dull	14.9	Soft, elastic	206	18.06	7.38	Normal	1.10
Red Fife	76.6	Cr.wh.L.dull	14.9	Elastic	200	17.94	7.25	Normal	1.10
Taylors Wonder	74.0	Wh.cr.	12.8	Elastic	199	17.31	6.63	Normal	1.08
White Fife	71.3	Wh.cr.L.dull	13.8	Elastic	202	17.69	7.00	Normal	1.07
Buffums #17	74.8	Cr.wh.L.dull	14.9	Soft, elastic	200	17.50	6.88	Normal	1.07
Kubanka	72.8	Y.wh.L.dull	14.2	Very soft, elastic	198	18.13	7.50	Normal	1.06
Prelude	76.9	Cr.dull	18.4	Soft, elastic	200	18.13	7.55	Normal	1.04
Club	76.2	Y. wh.	15.8	Soft, non-elastic	161	17.38	6.50	Shape Normal, Texture poor.	0.97
Alkali Resistant	70.1	Cr.wh.L.dull	14.9	Elastic	173	17.81	7.13	Normal	0.96
Conback	75.3	Wh.cr.dull	14.1	Very soft, Slightly elastic	150	17.63	6.88	Normal	0.91
Alaska	76.2	Y.L.dull	13.5	Soft, non-elastic	70	18.38	7.50	Top fallen	0.77
Average Normal	72.0	Cr.wh.dull	10.3	Elastic	202	17.44	6.88	Normal	1.00
Pioneer	75.1	Cr.wh.L.grey.	16.4	Soft, elastic	198	18.06	7.31	Normal	1.02

careless handling in elevators and other causes.

Unfortunately, when this seemingly excellent wheat was milled it was found that the flour was weak, resulting in a very heavy, compact loaf when made into bread and a crumbly, dark colored product when made into macaroni. The United States government ruled that any durum wheat containing more than 10 percent by weight of red durum should be classed as red durum. Fortunately but very little of this variety has been grown in Saskatchewan to date and it will not be necessary to introduce it, as varieties in Group VI will fulfil the requirements for a durum wheat.

Influence of the Time of Cutting on the Milling and Baking Value of Marquis Wheat.

During the years 1915 and 1916 tests were carried on with wheat cut at different stages in the development of the kernel. Four different stages were represented, the first of these being the milk stage; second, the early dough stage; third, the late dough stage; and fourth, when the kernels were hard and glazed.

Milling tests were made on the grain each year. In Table IX these results are given by years together with the averages.

As will be seen from an examination of the table, fairly conclusive results have been obtained. The relative value column

Table IV. Milling and Baking Tests, 1916 Crop.

	Flour		Gluten		Loaf				
Variety Name	Yield Percent.	Color	Percent dry Crude	Quality	Volume cu.in.	Wt.oz	Water used oz.	Shape & Texture.	Relative value.
Marquis	76.8	Wh.cr.dull	14.1	Elastic	193	17.81	7.06	Normal	$1.11
Taylor's Wonder	72.8	Wh.cr.L.dull	13.8	Elastic	195	17.25	6.63	Normal	1.10
Kubanka	78.0	Cr.wh.L.dull	13.2	Rather soft, elastic.	175	17.63	6.94	Normal	1.08
Hard Red Calcutta	72.9	Cr.wh.dull	12.4	Fairly elastic	192	18.19	7.50	Normal	1.06
Pioneer	74.0	Wh.cr.dull	15.1	Elastic	185	17.81	7.00	Normal	1.05
Kitchener	74.6	Wh.cr.L.dull	12.0	Rather soft, elastic	176	17.63	6.94	Normal	1.0[illegible]
Red Fife	78.0	Cr.wh.dull	14.9	Elastic	172	17.88	7.06	Normal	1.04
Red Bobs	74.3	Wh.cr.L.grey	12.7	Rather soft, elastic	176	18.13	7.44	Normal	1.01
White Fife	76.5	Cr.wh.L.dull	12.3	Rather soft, elastic	181	18.06	7.25	Normal	1.00
Buffums #17	70.5	Cr.wh.L.dull	13.6	Rather soft, elastic	150	17.56	6.63	Normal	0.97
Empire	76.6	Cr.wh.dull	13.9	Rather soft, elastic	162	17.50	6.81	Normal	0.93
Alaska	76.5	Cr.wh.L.dull	10.1	Rather soft, elastic	100	18.19	7.25	Flat top	0.85
Average Normal	72.0	Cr.wh.dull	11.4	Elastic	202	17.31	6.69	Normal	1.00
*Redstone	73.2	Cr. L.grey	14.4	Soft	111	17.81	7.19	Flat top	.823
Av. Normal	72.0	Cr.wh.L.grey	12.8	Elastic	198	17.81	7.19	Normal	1.00

* 1918 Crop,- special test of this wheat.

shows a difference of 22 cents between the first and last cutting, in favor of the latter. The difference of 18 cents between the first and second cutting is most significant when compared with a gain of only 4 cents from the second to the fourth cutting. Taking each of the important elements of the table individually it will be noted that the following statements may be made:

a. Loaf volume increases directly with the maturity of the grain.

b. Flour color improves noticeably with maturity, the early cuttings all being a little greyish in color.

c. The per cent of gluten increases directly.

d. Weight of loaf and water absorption decrease slightly.

In conclusion it may be stated that it is very important to allow the wheat to reach at least the dough stage before cutting, preferably the late dough stage. Further improvement of a substantial nature may be obtained by allowing the wheat to reach the hard glazed condition, but looking at the situation from the milling and baking standpoint only, the difference is not great enough to warrant the farmer taking any great risks in getting his crop harvested.

Immaturity is undoubtedly detrimental to the milling and baking value of wheat grain.

Table V. Milling and Baking Tests, 1917 Crop.

Variety Name.	Absorption percent.	Wt. of dough grs.	Loaf volume c. c.	Color.	Texture.	Shape.	General Appearance.	Remarks.
(Standard)	67	502	1530	100	100	Not given.	100	
Siberian	65	493	1600	102	104	"	104	Gives excellent loaf in every reppect.
White Fife	66	495	1560	101	101	"	100	Gives large loaf of good color, texture and shape
Red Fife	66½	499	1540	100	100	"	100	Loaf well shaped and fine crust, but texture slightly coarse.
Marquis	65	491	1510	101	100	"	98	Loaf slightly smaller than Red Fife but of equal texture.
Red Bobs	65	496	1520	100	96	"	100	Resembles Marquis. Volume and color good, texture fair
Taylors Wonder	65	493	1530	100	92	"	98	Volume and color good;;texture rather coarse.
Kitchener	65	494	1500	98	102	"	98	Loaf slightly darker than Marquis but texture better
Pelissier	69	509	1350	Very Yellow	Coarse	"	Small & Shrunken	Yields yellow granular flour. Loaf small, texture coarse, very yellow color.
Kubanka	67	498	1250	Very Yellow.	Coarse	"	Small & Shrunken	Very similar to Pelissier, but loaf smaller.

Table VI. Milling and Baking Tests, 1918 Crop.

Variety Name.	Absorption percent.	Wt. of dough grs.	Loaf volume C. C.	Color.	Texture.	Shape.	General Appearance	Remarks.
(Standard)	68.0	511.	1455	100	100	.51	100	
Marquis	62.5	496	1435	98	98	.54	100	Yields flour of excellent baking quality.
Red Bobs	64.0	499	1430	97	95	.50	100	Very similar to Taylors Wonder, but texture slightly better.
Taylors Wonder	60.5	489	1460	98	93	.50	100	Very good loaf but texture decidedly coarse
Kitchener	64.0	499	1425	98	97	.49	99	Yields flour of good average baking quality.
White Fife	62.5	495	1430	97	94	.48	98	Yields flour of fairly good baking quality.
Siberian	65.5	505	1360	95 grey	97	.50	99	Flour of good baking quality although somewhat grey in color.
Red Fife	65.0	501	1355	96	91	.49	97	Loaf only of fair quality. Coarse in texture and dark
Ruby	65.5	504	1320	97	96	.43	96	Flour weak and general quality of loaf only fair
Kubanka	65.5	503	1310	yellow	Coarse	sunk	Very poor	Flour high in ash and of very inferior baking quality.
Pelissier	70.5	518	1235	Very yellow	Very coarse	sunk	Very poor	Poorer milling wheat than Kubanka.

Table VII. Milling and Baking Tests, 1919 Crop.

Variety Name.	Absorption percent.	Wt. of dough grs.	Loaf Volume. c.c.	Color.	Texture.	Shape.	General appearance	Remarks.
Marquis	60.0	488	1660	100	100	.57	100	Excellent loaf in every detail
Kitchener	59.5	488	1510	95	94	.46	96	Good loaf but texture rather coarse.
White Fife	60.0	488	1430	94	93	.53	98	Fairly good loaf but texture somewhat coarse.
Red Fife	59.5	486	1400	92	93	.51	97	Only fair loaf. Color and texture rather poor.
Taylors Wonder	59.0	485	1420	92	87	.46	94	Rather poor; very coarse texture.
Red Bobs	62.5	493	1270	86	88	.40	89	Poor loaf.
Felissier	64.0	500	1335	Bright Yellow	93	.38	92	Very poor loaf but better than Kubanka
Kubanka	63.5	497	1130	Bright Yellow	Close & heavy	sunk	bad	Very poor loaf.
Pioneer	60.5	490	1370	96	92	.45	95	
Prelude	61.0	491	1450	Yellow 93	96	.47	97	
Quantity	58,8	484	1410	Very Yellow	88	.47	95	

Influence of the Time of Seeding on the Milling and Baking Value of Marquis Wheat.

For a period of three years (1914-1916) a series of tests were made on wheat seeded at five different dates.

The results of these tests, given in Table X are apparently not very conclusive. The averages of the relative values for each of the five different dates, beginning with the first, are as follows, \$1.08 \$1.05, \$1.08, \$1.09 and \$1.04. The average for the last date is pulled down very considerably by the 1916 sample which was probably very badly rusted. It had a relative value of only \$0.93. The loaf volume varied in much the same manner; first date 202 cu. in.; second date 193 cu. in.; third date, 200 cu. in.; fourth date 202 cu. in.; fifth date 193 cu. in. The fifth date again suffered from the poor quality of the 1916 sample. An inspection of the results by years will show that the flour from the later dates was inclined to be dull, creamy, or greyish.

The conclusions to be arrived at from these tests are fairly obvious. The time of seeding has very little influence on the quality of the wheat grain produced, provided that the crop is early enough to escape rust and frost damage. The results give no further information than those made directly on wheat which has been injured due to lateness of maturity.

Importance of the Milling and Baking Test in Breeding Work.

The plant breeder who undertakes the improvement of any particular strain or variety of wheat uses in his procedure of rigid selection only those characteristics which are outwardly apparent. The milling and baking quality of his selections, he is not in a position to judge with accuracy as he cannot depend upon the ap-

Table VIII. Milling and Baking Tests, 1920 Crop.

Variety Name.	Protein Percent.	Absorption percent.	Loaf Volume C. C.	Color	Texture.	Shape.	General appearance.	Remarks.
Standard.	13.01	65.0	2260	100	100	Not Given.	100	
Kitchener	12.67	58.0	2680	99	99	"	106	An excellent loaf in every particular
Marquis	13.40	58.0	2750	98	97	"	105	Large well piled loaf of good color and texture.
Red Bobs	13.01	57.5	2920	97	96	"	105	An exceedingly large loaf of good color and fair texture.
Red Fife	14.84	58.0	2750	100	98	"	104	A large loaf of excellent general quality.
Ruby	13.23	56.0	2880	92 Grey.	96	"	106	A very large loaf but decidedly grey in color.
Early Red Fife	12.62	60.0	2060	98	96	"	97	Rather small loaf; good color and fair texture.
Taylor's Wonder.	13.25	60.0	2100	95	95	"	96	Loaf somewhat small coarse in texture and dull in color.
Kubanka	15.12	60.5	2090	Very Yellow.	95	"	95	Small loaf of coarse texture and extremely yellow color.
Pelissier	14.93	62.0	1960	Very Dark	80	"	92	Very poor loaf; small, coarse and dark.
Redstone	13.76	59.5	1890	86	86	"	86	Very poor loaf.
Kinley	13.60	61.0	1860	80 very dark.	80 very coarse.	"	80 very poor.	Very poor loaf, small, dark and coarse.
Red Durum (D-5)	16.2	63.0	1900	Very dark and Yellow	84	"	82	Similar to Pelissier.

pearance of the grain alone. Obviously, a milling test must be made upon the grain as soon as the selection has reached the stage where a sufficient quantity is available for this purpose. Needless to say the results obtained are very often surprising. Some selections producing very fine appearing samples of grain have been known to give exceptionally poor results in the milling and baking test. Others show marked improvement over the mother variety and it is this marked improvement which we would like to emphasize.

In the year 1914 a large number of selections were made from Red Fife, some of which have given very promising yields. Every other year while these selections are being grown in the one-hundredth acre plots for the purpose of obtaining comparative yields, etc., samples are taken from them for milling and baking tests. In table XI are given the results of these tests on two of the best and two of the poorest of these strains. The tests on the mother variety are also given for purposes of comparison. It will be noted that the two strains Red Fife 4814 and Red Fife 3314 have consistently given better results than the mother variety. In 1917 Red Fife 3314 fell slightly below the mother variety in both color and texture but was higher in loaf volume. In 1919 it gave much better results than the mother variety and in the average for the two years

Influence of the Time of Cutting on the Milling and Baking Value of Marquis Wheat.

Table IX.

Stage of Maturity.	Year.	Grain Moisture	Water used.	Yield	Dry Crude Gluten	Color quality.	Volume of Loaf.	Shape & texture.	Weight of Loaf.	Relative value.
Milk Stage.	1915	12.5	8.31	60.6	11.8	Greyish white.	160	N.	19.00	$0.83
" "	1916	11.4	7.69	73.0	13.8	Wh.cr.L. grey	167	N.	19.44	0.99
" "	Av.	11.9	8.00	66.8	12.8		164	N.	18.72	0.91
Early Dough	1915	12.9	7.31	72.5	13.6	Wh.cr.L dull	203	N.	18.00	1.07
" "	1916	8.6	8.13	75.0	13.7	Wh.cr. dull.	175	N.	18.88	1.10
" "	Av.	10.8	7.72	73.8	13.7		189	N.	18.44	1.09
Late Dough	1915	12.4	7.06	77.2	14.7	Wh.cr. dull.	203	N.	17.75	1.06
" "	1916	10.2	7.44	78.3	13.5	Wh.cr. dull.	186	N.	18.13	1.10
" "	Av.	11.3	7.25	77.8	14.1		195	N.	17.94	1.08
Hard and Glazed.	1915	12.8	7.13	75.8	15.6	Cr.wh.L. dull	208	N.	17.81	1.06
" "	1916	9.2	7.38	76.5	12.9	Wh.Cr.L dull.	202	N.	18.00	1.19
" "	Av.	11.0	7.25	76.2	14.3	Wh.cr.L. dull.	205	N.	17.91	1.13

is decidedly the better in loaf volume and somewhat similar in color and texture. Red Fife 4814 has excelled the mother variety in almost every particular in both years of the tests. In 1917 good tests were obtained from nearly all fair quality wheats but this strain shows its superiority by the excellent results obtained. The following tests in 1918 were not as good as the average but again this particular strain proved better than its progenitor. The other two strains Red Fife 1914 and Red Fife 3714 as indicated by the results have consistently proven themselves of exceptionally poor quality.

Similar results have been obtained with selections from other varieties. In Table XII the results of the tests on the 1917 crop of selections from Red Bobs are given. It will be observed that there is a great deal of variation in the milling and baking quality; practically every stage between excellent and poor being represented.

In conclusion, it may be stated that the making of milling and baking tests on strains under trial is of great value. It gives an accurate indication of any improvement in the quality which is being made, and furthermore it enables the breeder to eliminate the poor quality strains with a considerable degree of certainty, thus saving a great deal of labor and expense, and eliminating the chance of distributing a poor quality wheat.

Influence of the Time of Seeding on Milling and Baking value of Marquis Wheat.

Table X.

Time of Seeding.	Year	Grain Moisture.	Water used	Yield	Dry Crude Gluten.	Color Quality.	Volume of Loaf.	Weight of Loaf.	Shape & Texture.	Relative Value.
April 10th	1914	13.2	7.13	74.0	13.8	Wh.cr.L. dull.	207	17.94	N.	$1.05
10th	1915	12.0	7.19	73.0	13.6	Cr.wh.L. dull.	206	17.81	N.	1.11
10th	1916	12.6	7.44	76.0	10.0	Wh.cr. dull.	192	18.13	N.	1.08
	Av.	12.6	7.25	74.3	12.5		202	17.96	N.	1.08
April 20th.	1914	12.8	7.50	75.2	14.4	Wh.cr.L greyish.	190	18.25	N.	1.03
20th	1915	13.0	7.44	74.6	13.2	Wh.cr.L. dull.	194	18.13	N.	1.04
20th	1916	13.0	7.19	76.0	13.4	Wh.cr.L dull.	196	17.88	N.	1.07.
	Av.	12.9	7.38	75.3	13.7		193	18.09	N.	1.05
April 30th	1914	12.4	7.06	74.5	14.4	Wh.cr.L dull.	195	17.88	N.	1.03
30th	1915	12.8	7.38	74.9	14.2	Wh.Cr.L. dull.	205	18.06	N.	1.10
30th	1916	12.0	7.38	72.5	13.0	Wh.cr. dull.	200	18.06	N.	1.11
	Av.	12.4	7.27	74.0	13.9		200	18.00	N.	1.08
May 10th	1914	12.9	7.31	73.0	14.2	Wh.cr.L. greyish.	200	18.06	N.	1.04
10th	1915	13.5	7.06	74.3	14.0	Wh.cr.L. dull.	211	17.69	N.	1.11
10th	1916	12.4	7.38	73.1	12.4	Cr.wh.L. dull.	195.	18.06	N.	1.11.
	Av.	12.9	7.25	73.5	12.5		202	17.97	N.	1.09
May 20th	1914	13.4	7.44	72.5	14.4	Wh.cr.L. dull.	191.	18.13	N.	1.06
20th	1915	13.4	7.31	75.6	13.9	Cr.Wh.L. dull.	207	18.00	N.	1.14
20th	1916	13.2	7.06	68.0	10.1	Cr.dull.	181	17.88	N.	0.93
	Av.	13.3	7.27	72.0	12.8		193	18.00	N.	1.04

Difference in Baking Value between strains of Red Fife.

Table XI.

Variety.	Year grown.	Absorption.	Wt. of Dough.	Cylinder Volume.	Loaf Volume.	Color.	Texture.	Shape.	Gen. Appearance.
Red Fife (Stand.)	1917	66	499	360	1540	100	100		100
Red Fife (Stand.)	1919	59.5	486	350	1400	92	93	.51	97
Average	1917 & 1919	62.8	493	355	1470	96	97		99
Red Fife #4814	1917	66.0	504	340	1560	102	102	Good	Good.
Red Fife #4814	1919	63.5	493	325	1460	96	94	.40	95
Average &	1917 & 1919	64.8	499	333	1510	99	98		
Red Fife #3314	1917	64.0	498	350	1580	94	96	V.G.	V.G.
Red Fife #3314	1919	61.0	494	300	1490	95	94	.47	95
Average	1917 & 1919	63.0	496	325	1535	95	95		
Red Fife #1914	1917	64.0	496	310	1330	Very Yellow	82	Very Poor	Very Poor.
Red Fife #1914	1919	61.5	490	285	1110	82	Very Heavy and Coarse.	Sunk	Sunk
Average	1917 & 1919	62.8	493	298	1221	80	75		
Red Fife #3714	1917	64.0	498	300	1460	90	80	Very Poor	Very Poor.
Red Fife #3714	1919	61.0	489	260	1150	87	Heavy and Coarse	Sunk	Sunk
Average	1917 & 1919	63	494	280	1305	89	75		

Influence of Climate and Soil Conditions on the Milling and Baking Value of Marquis Wheat.

This is a subject which is more or less beyond the scope of this discussion and furthermore no direct attempt has been made to investigate it. Each year samples of wheat are received from different points in the province to be entered in the Millers Cup Contest. The tests from these samples it was thought at one time, would enable us to form a fair estimate of the quality of wheat produced by the different districts. On further study of these results, however, it was decided that definite conclusions could not be drawn from them. The results of the tests on all of the samples of Marquis wheat entered in this contest in the years 1917 and 1920 are given in Tables XIII and XIV. Apparently no particular district shows evidence of producing wheat of outstanding high or low quality. It is true that in a number of cases the best samples have come from the same district, but it is also true that they have usually come from the same grower. From this it might be inferred that any district suitable for successful wheat growing may produce very high quality wheat if the growers make an attempt at improvement.

Table XII. Milling and Baking Tests on Strains of Red Bobs, 1917 Crop.

Strain Number.	Absorption Percent.	Wt. of. Dough. Grs.	Loaf Volume. C.C.	Color.	Texture.	Shape.	General Appearance.
147-14	61.0	495	1670	102	98	Excellent	Excellent.
148-14	61.0	493	1650	98	98	Excellent	Excellent.
142-14	63.0	504	1630	98	98	Very good	very good
143-14	62.0	496	1620	102	102	Excellent	Excellent.
168-14	61.5	495	1610	98	96	Very good	Good.
150-14	61.0	493	1600	98	94	Very-Good	Very good.
163-14	61.0	495	1600	97	94	Fair	Good
154-14	61.0	495	1580	96	92	Good	Good
158-14	61.0	493	1570	98	92	Fair	Good.
169-14	62.5	500	1570	98	96	Very good	Very good.
141-14	62.0	498	1560	100	94	Very good	Very good
164-14	61.5	495	1540	Very Dark	Very coarse	Poor	Poor.

Table XIII. Milling and Baking Tests on Marquis Wheat from Different Points in the Province, 1917.

Name of Grower.	Where Grown.	Flour		Gluten.		Loaf.				
		Yield Percent.	Color.	Percent dry Crude.	Quality.	Volume cu.in.	Wt.oz.	Water used oz.	Shape & Texture	Relative Value
Seager Wheeler	Rosthern.	78.6	Wh.cr.dull.	15.3	Elastic.	198	18.06	7.44	N.	$1.18
John Dennis	Prince Albert.	77.0	Wh.cr.dull.	14.6	Very elastic.	198	17.94	7.25	N.	1.17
W.J.F.Warren	Belbeck	79.1	Wh.cr.dull.	15.4	Stiff, elastic.	193	17.69	7.06	N.	1.13
Smith Bros.	Prince Albert	78.4	Wh.cr.dull.	16.6	Rather soft, elastic.	190	17.63	7.00	N.	1.13
Wheeler Bros.	Scott	77.0	Wh.cr.dull	13.6	Tough elastic.	188	18.06	7.44	N.	1.12
H. P. Ferguson	Perdue	76.1	Wh.cr.dull	15.2	Rather Soft, Elastic.	187	18.13	7.50	N.	1.09
Chas. White.	Prince Albert	79.3	Wh.cr.dull	14.3	Tough Elastic.	185	18.00	7.31	N.	1.08
D. C. McWirter.	Rockhaven	77.1	Wh.cr.dull	13.6	Stiff, Elastic.	184	18.00	7.38	N.	1.09
Frank White.	Davis	78.8	Cr.wh.L. grey.	16.2	Rather-soft, elastic.	184	18.00	7.25	N.	1.11

Table XIV. Milling and Baking Tests on Marquis Wheat from Different Points in the Province, 1920.

Name of Grower.	Where Grown.	Absorption %	Loaf volume c.c.	Color	Texture	General appearance	Remarks.
W.J.F.Warren	Belbeck.	61.0	2280	103	100	101	An excellent loaf in every respect.
Seager Wheeler	Rosthern	59.0	2200	102	98	100	A very good loaf but slightly coarse in texture.
R.M.McCurdy	Asquith	61.0	2220	98	98	102	A very good loaf, slightly down in color and texture.
Davis Bros.	Perdue	59.5	2210	98	97	100	Very good loaf, slightly down in texture.
John Alston	Prince Albert	59.0	2220	98	95	100	Good loaf, but somewhat coarse in texture.
Grenfell Agri. Soc.	Grenfell	61.0	2390	99	95	102	A large loaf of good color but poor texture.
W. J. Mathieson	Tuxford	59.0	2250	100	96	101	A large loaf of good volume, but somewhat coarse in texture.
Alex.Finlayson	Foam Lake	58.0	2200	94	94	97	Very large loaf, but color rather poor.
D. M. Elder	Wild Rose	60.0	2080	97	96	98	Fair loaf, rather coarse in texture.
Reid Bros.	Foam Lake	60.0	2150	96	94	97	Fair loaf but of coarse texture.
R. O. Wyler	Luseland	58.5	2380	96	97	102	Fair loaf, down in color and texture.
K. Canfield	Shellbrook	59.0	2000	95	93	95	Small, and of poor color and texture.
G. S. Canfield	Wild Rose	61.0	1900	95	93	93	Small, coarse textured loaf.

Table XV - Milling and Baking Test on Acme and Kubanka Wheats - 1921.

	Flour.		Gluten.		Loaf.			
Variety.	Yield Percent.	Color.	Percent dry Crudo.	Quality	Volume Cu.in.	Weight oz.	Water used oz.	Shape & texture.
Acme	71.4	Wh.cr.dull.	11.9	Rather soft f.E.sticky.	155.	18.00	7.25	Nm
Kubanka	70.2	C.Wh.dull.	14.1	F.E.rather sticky.	127.	17.69	6.94	Nm.

Within the province then, although there must exist a considerable difference between the quality of wheat produced by different districts and in different seasons, as is evidenced by the prevalence of piebald and starchy kernels among samples from northern areas, no direct evidence in favor of this hypothesis has so far been brought forward. At the most we must depend on indirect evidence such as that furnished by test on wheat containing piebald and starchy kernels.

It is our belief that this phase of the milling quality problem, namely, the quality of the same variety produced in different districts, should be investigated in an extensive manner in order to clear up questions remaining in doubt. Such studies carried on in Kansas have proved productive of much information of economic value to both grower and miller.

Le "Glaisage" Des Terres

Par L. Philippe Roy,
Chef du Service de la grande culture, Québec

L'apport d'amendements physiques sur les terres arables en vue de corriger leurs défauts et de les rendre plus propices à la culture, est une pratique connue depuis très longtemps.

Bien qu'il soit théoriquement admis que les principaux constituants physiques des sols, (silice, argile, calcaire et humus) peuvent être, suivant le cas, employés pour amender les terres aux propriétés excessives, il est assez rare que, dans la pratique de l'exploitation de celles destinées à la grande culture, on ait recours aux amendements sableux et argileux. Les quantités des matériaux à transporter, pour incorporer le correctif nécessaire, sont trop considérables pour que ce travail soit recommandé en stricte économie. Au surplus, il est généralement assez difficile de mélanger l'argile à une terre sablonneuse de manière à en obtenir un mélange homogène.

En dépit de ces faits, il existe certaines conditions particulières où le transport, même considérable, de matières argileuses sur un sol, en vue d'en améliorer la composition, semble pouvoir être préconisé.

Il nous a été donné de visiter récemment un district de notre province où les terres, composées presqu'exclusivement de sable silicieux, sont devenues à peu près complètement stériles.

La paroisse de St-Raymond, dans le comté de Portneuf, constitue un exemple typique duquel il est facile de tirer deux conclusions, à savoir:

1.—Qu'on ne devrait jamais défricher inconsidérément des surfaces plus propices à la production du bois qu'à celle des cultures.

2.—Qu'une fois défrichées, ces terres sablonneuses, initialement peu fertiles, devraient être exploitées avec le plus grand soin et de manière à y maintenir l'état de fertilité.

A l'époque du défrichement, ces terres sablonneuses du district de St-Raymond, sous la poussée de matière végétale qui s'était accumulée à la surface du sol et des cendres laissées par les "brûlés," donnaient des récoltes suffisantes pour assurer la subsistance de cultivateurs. Ceux-ci, comme le font généralement tous les colons, se sont installés en permanence, construisant des routes, un village considérable et de beaux édifices publics.

Malheureusement mais logiquement, l'aisance qui a marqué la période de début de cette paroisse ne devait pas se continuer longtemps. A la faveur d'un système d'exploitation défectueux, le sol s'est vite épuisé et aujourd'hui le cultivateur doit semer sur un sable très pauvre et ne répondant plus aux soins qu'on lui donne. Cet état d'épuisement existe depuis un grand nombre d'années et les cultivateurs désertent leurs fermes faute de pouvoir en retirer les revenus nécessaires à la vie.

Il est assez singulier de noter ici qu'un certain nombre de fermiers, parmi les plus attachés à leur terre, ont pris d'eux-mêmes l'initiative de chercher à l'amender et à l'améliorer, par l'apport d'argile. Cette opération est vulgairement appelée "glaisage" des terres.

Grâce à certains dépôts argileux qui, à un moment donné de la formation des sols de l'endroit, ont été laissés sur les bords de la rivière Ste-Anne, laquelle traverse la paroisse sur une grande largeur, il est relativement facile pour presque tous les cultivateurs de se procurer l'argile à une très faible distance. Cette argile, bien que presque dépourvue d'éléments calcaires a un effet très améliorant sur ces terres de sable. Les premiers cultivateurs qui ont tenté cette expérience, il y a une vingtaine d'années, remarquent que les sols "glaisés" deviennent rapidement aptes à produire toutes les récoltes de la ferme.

Voyant la désertion des cultivateurs prendre des proportions alarmantes, les autorités de la paroisse ont, l'an dernier, établi une organisation dans le but de favoriser le "glaisage" de certaines surfaces de leurs fermes.

Ce travail de charroi se fait de préférence au cours de l'automne ou de l'hiver et ne dérange pas le cultivateur dans ses travaux de culture.

On considère qu'il faut de 250 à 300 charges (1,200 livres) de glaise à l'acre pour apporter l'amélioration désirée.

Cette glaise est d'abord déposée sur le sol en petits tas à la manière des fumerons. Lorsqu'elle a subi les effets de la gelée, elle peut facilement être étendue et incorporée ensuite au sol au moyen d'un léger labour ou d'un hersage à la herse à disques. Nous avons noté que ces terres, une fois amendées, prennent la consistance des terres franches et produisent des récoltes des plus satisfaisantes. Il est facile de constater, même quelques années après le "glaisage", que c'est aux endroits où furent déposés les petits tas de glaise et où la quantité appliquée a été plus considérable, que les récoltes sont les plus abondantes et que le trèfle se maintient le plus longtemps.

A la faveur de cette organisation paroissiale dont nous avons parlé plus haut, un nombre d'à peu près 40 cultivateurs de la paroisse de St-Raymond ont charroyé, au cours de l'hiver dernier, au-delà de 50,000 charges de glaise sur leurs terres et ces travaux se continueront vraisemblablement dans l'avenir.

Plusieurs autres paroisses des comtés de Portneuf et de Champlain qui sont à peu près dans les mêmes conditions, désirent s'organiser de la même manière, de sorte que ce mode d'amendement des terres sablonneuses au moyen de l'argile pourrait devenir assez usité dans ces parties de la province où les sols sont silicieux et dépourvus de matière végétale.

Si l'on étudie cette opération au strict point de vue économique, il est possible, qu'à prime abord, nous trouvions qu'elle n'est guère pratique, à cause du travail énorme nécessité pour rendre la terre propre à la culture. Il ne faudrait cependant pas conclure trop rapidement à la faillite de cette amélioration qui a été mis à l'épreuve par les cultivateurs eux-mêmes.

On considère qu'en amendant ainsi quelques arpents de terre sur sa ferme, le cultivateur pourra rapidement augmenter la production de ses cultures et aussi le nombre de têtes de son troupeau, ce qui permettra de produire plus de fumier et de pouvoir ensuite mieux traiter et de mettre en état de production la balance de terre non amendée. Par ailleurs, il s'agit, dans le cas actuel, de tirer le meilleur parti possible d'une situation dans laquelle ont été mis les cultivateurs de l'endroit par suite d'un défrichement inconsidéré. L'abandon général des fermes par leurs propriétaires occasionnerait la perte d'un énorme capital qui a été investi non seulement pour la mise en culture des terres mais aussi pour la construction de routes, de bâtisses publiques et d'améliorations diverses. Ce n'est qu'après avoir bien considéré ces différents points qu'il est possible de se rendre compte de l'opportunité d'une telle pratique au point de vue économique.

L'Achat Des Engrais Chimiques

Par B. Bourgault,
Du Service fédéral de l'inspection des semences, Québec

L'emploi des engrais chimiques en agriculture a rencontré bien des objections et des préjugés qui, heureusement, tendent à disparaître depuis que le cultivateur connaît mieux le rôle de ces engrais complémentaires. S'il est important de savoir les employer avec discernement, il est aussi très important de savoir les acheter avec sagesse.

Bien des abus et des falsifications se glissent dans le commerce de ces produits et le cultivateur doit s'intéresser aux lois qui sont édictées pour le protéger contre des vendeurs trop peu scrupuleux. Il doit savoir qu'il existe une loi règlementant la vente des engrais chimiques, lesquels, d'après cette loi, doivent porter un numéro d'enregistrement. Ce numéro d'identification doit apparaître d'une manière claire et lisible sur chaque récipient, sac ou poche d'un engrais agricole offert en vente au Canada. Avec ce numéro d'enregistrement doit figurer sur chaque récipient une analyse garantie, donnant les "pour cent" minimum des éléments fertilisants contenus dans les produits offerts en vente ainsi que la marque de commerce au nom de l'engrais et l'adresse du manufacturier. Cette législation constitue une sauvegarde précieuse pour le cultivateur qui trop souvent néglige de se mettre au courant des lois qui lui assurent une protection appré-

-ciable pour des achats de produits facilement altérables.

On ne saurait donc attacher trop d'importance à ces connaissances nécessaires pour pouvoir faire promptement et facilement un estimé assez juste sur un engrais offert par un agent vendeur. Il en est des engrais chimiques comme des variétés de grains: les noms ou titres les désignant ne manquent pas de sonorité et de patois; ces désignations exigent parfois des dépenses assez considérables et toujours des efforts d'imagination peu commune. Il ne faut donc pas se laisser influencer par ces genres de réclame. Il est beaucoup plus sage d'examiner et d'étudier l'analyse du produit offert pour se faire une idée juste de sa valeur comme source de nourriture pour les plantes. Cette étude de l'analyse des éléments fertilisants consiste à considérer le pour cent de ces éléments, azote, acide phosphorique assimilable et potasse. Certaines analyses offrent une foule de détails aussi inutiles qu'incompréhensibles pour le cultivateur; ce serait une erreur de croire que ces longues nomenclatures augmentent d'autant la valeur d'un engrais. Illustrons d'un exemple, certains procédés en usage dans les analyses que nous rencontrons parfois:

Azote	1.64%	à	2%
Egal en ammoniac....	2.00%	à	2.50%
Acide phosphorique soluble dans l'eau....	6.00%	à	7.00%
Acide phosphorique soluble dans l'acide nitrique.	2.00%	à	3.00%
Acide phosphorique assimilable.	8.00%	à	10%
Total	9%	à	12%
Potasse	2%	à	4 %
Egale en sulfate de potasse	4%	à	8 %

Une telle analyse est de nature à provoquer l'embarras sinon l'admiration du cultivateur envers le manufacturier qui lui offre un produit dont les détails semblent annoncer un engrais qui, si riche, ne manquera pas de fournir une nourriture plus qu'abondante à la végétation qui en devra bénéficier.

Cependant, si de l'analyse ci-dessus mentionnée l'on veut éliminer tout ce qui n'est pas "pratiquement" utilisable par la plante, voici à quoi se réduit cette analyse et ce qu'il faut payer dans un engrais qui est désigné comme tel:

Azote	1.64%
Acide phosphorique assimilable. .	8%
Potasse	2%

C'est tout ce qui peut intéresser pour l'excellente raison que c'est tout ce qui est utilisable. Dans un engrais complet, il n'y a donc à tenir compte que de ces trois énumérations mentionnées sur l'analyse: le pour cent de l'azote, de l'acide phosphorique assimilable, de la potasse.

Après ces quelques considérations, il faut donc conclure que le cultivateur doit user d'une grande prudence dans les achats de cette nature, ne pas se laisser influencer par les belles histoires et les faits merveilleux d'un engrais qui lui est offert. L'analyse seule doit attirer et retenir son attention et s'il n'en découvre pas clairement la valeur réelle, il doit en homme sage, se renseigner avant de prendre une décision et conclure un marché.

NOUVELLES

Revue de Bontanique appliquée et d'agriculture coloniale. Organe de l'Association internationale de Botanique appliquée et du Laboratoire d'Agronomie coloniale de l'Ecole pratique des Hautes Etudes, publiée sous la direction de M. Aug. Chevalier, chef de la Mission permanente d'agriculture coloniale au Ministère des Colonies, directeur du Laboratoire d'Agronomie coloniale, ancien directeur du *Journal d'Agriculture tropicale.* Abonnement 25 frs, 57 rue Cuvier, Paris.

M. Aug. Chevalier a fondé en 1921 la Revue Botanique appliquée et d'Agriculture coloniale. Réduite à 4 fascicules de 384 pages en 1921, elle paraît depuis janvier 1922 par bulletins mensuels de 40 pages au moins comprennant les rubriques suivantes: 1. Etudes et dossiers; 2. Notes et Actualités; 3. Bibliographie; 4. Nouvelles.

Le but de cette nouvelle publication est de tenir le public au courant des recherches et des applications de la science botanique au progrès de l'agriculture et de l'exploitation des forêts dans le monde en publiant des travaux originaux, des dossiers, des informations, des analyses bibliographiques plus ou moins étendues concernant les diverses cultures et les principaux produits

forestiers du globe. Elle renseigne ses lecteurs sur les progrès qui peuvent être réalisés dans l'agriculture métropolitaine et coloniale en suivant les études sur les cultures des pays tempérés, des régions méditerranéennes et des contrées tropicales.

ETRE MEMBRE

L'association c'est le groupement des volontés autour d'une même idée, pour un même but, en vue d'un même idéal. La Société des Agronomes canadiens s'est organisée au sein de la profession agricole avec un programme et des statuts conformes à son objet.

Notre société ambitionne avant tout le développement de la compétence professionnelle de ses membres. Elle demande à chacun d'entre nous d'étudier, de réfléchir, d'observer, de comparer et de conclure en hommes pratiques. Elle veut que notre action directe porte des résultats évidents au profit de la classe agricole, au service de laquelle nous nous sommes consacrés. C'est l'idéal ultime de l'association dont plusieurs centaines de techniciens font partie.

Est-il vrai, cependant, que tous les associés comprennent cet idéal et visent à le réaliser? Nous en doutons pour quelques rares unités. Mais nous ambitionnons, pour tous et pour chacun le plein succès professionnel de nos confrères. Et c'est pourquoi nous voudrions qu'on prenne en bonne part les amicales remarques que nous nous permettons de soumettre à ceux qui sont "membres."

Nos études agricoles nous ont mis en main une clef, celle de l'expérience. Nos éminents et dévoués professeurs, ceux de Guelph, de Macdonald, d'Oka et de Ste-Anne nous ont mille fois répété que les connaissances de mémoire sont de peu de valeur sans le concours du jugement et de l'esprit d'observation. Or, le jugement s'acquiert par l'observation. Et l'expérience n'est autre chose que la leçon des faits observés. Si cette leçon est appliquée conformément aux conditions économiques, au sol, au climat, à la distance des marchés, à la fortune des gens, elle a toutes les chances de porter de bons fruits. Se servir ainsi des leçons de l'expérience c'est user de jugement.

N'allons pas nous tromper. Il y a des hommes, plus hardis et plus frondeurs que leurs semblables, à qui l'abondance oratoire suffit et qui vont risquer n'importe quelle théorie sans se soucier des échecs désastreux que son application occasionnera. Ils manquent de prévoyance et l'autorité de leur enseignement ne saurait avoir un long règne. A tout prendre, il vaut mieux n'enseigner que peu de choses, de celles que l'on peut confirmer par des faits certains, et confesser son ignorance pour le reste.

Il est des hommes qui s'adonnent au développement agricole et qui seraient nés pour une mission toute autre. Ceux-là ont besoin plus que d'autres d'user de jugement s'ils ne veulent pas faire de mal à notre agriculture. Il ne suffit pas d'être riche d'enthousiasme ou de finance, il faut le sens professionnel et l'âme de la mission que l'on a embrassée. Il faut de l'étude, de l'abnégation, du dévouement véritable dans le sens même des besoins en face desquels on s'est placé.

Or, nous oserons le dire, pour être réellement utile à ses compatriotes ruraux il faut la vocation de l'apôtre, du patriote, du terrien de coeur et d'esprit, clairvoyant, averti, laborieux et réfléchi. Il faut parfois l'abnégation de l'idée personelle, de l'opinion préconçue, du préjugé. Il faut aussi, dans notre siècle d'avancement général, la science parfaite des principes, la connaissance des causes et des effets. La Société des Agronomes ambitionne de trouver ces qualifications réunies dans chacun de ses membres. Elle fera pour ceux qui les possèdent, tout ce que son autorité lui permet d'accomplir, en mettant devant nos yeux les plus beaux exemples de compétence professionnelle. Et son ambition la plus chère est de pouvoir, un jour, proclamer que tous ses membres sont des agronomes supérieurs ,des apôtres infatiguables et des guides éclairés pour la classe agricole qui travaille à la lumière de leur enseignement.

Avons-nous la fierté du blason qui est nôtre? Etre membre d'une telle Chevalerie, c'est porter un beau et noble titre.

A. DESILETS, B.S.A.
Président de la Section de Québec.

L'ARTICLE DE M. MAHEUX

Les épreuves de l'article de M. Maheux: "Les insectes dans nos serres" paru dans le dernier numéro de la Revue Agronomique, n'ayant pas été corrigées, faute de rédacteur français, l'auteur y relève un grand nombre de fautes.

Nous le regrettons.

Diseases of the Potato

by B. T. DICKSON,
Professor of Botany, Macdonald College.

(Continued)

Group 7. Diseases caused by Fungi Imperfecti (Adelomycetes or Deuteromycetes).

(a) **Early Blight.**

This disease is common in years when Late Blight does not occur and while it does not attack the tubers the yield is reduced because of leaf injury. The amount of injury depends upon the season and it is greatest when hot spells alternate with moist weather. In such cases losses in yield may reach as high as 25 percent, unless spraying is consistently practised. The disease is caused by a fungus known as *Alternaria solani* (E. & M.) J. and G.

Symptoms.

During the season the leaves are the only parts attacked. The first sign of the disease is a small yellowish spot with a slightly watersoaked margin. The spot enlarges until it is from 1-8 to 1-4 of an inch in diameter and variations in the growth rate of the fungus give rise to concentric markings in the spots. The whole becomes dried out and brownish-black and it frequently happens that the central part of the lesion falls out giving rise to a modified "shot-hole" effect. When the disease is severe owing to suitable infection conditions several spots may coalesce. Under these circumstances the foliage is considerably reduced and at times very few mature leaflets will have any chlorophyll bearing tissue with which to function in manufacturing food for plant growth and tuber development. Persistence of these conditions will involve the premature death of the vines.

The stems are not affected until late in the season and it is in debris from vines and leaves that the fungus overwinters.

Life History.

The fungus may overwinter as mycelium in old lesions in plant debris or as spores but there is no known perfect stage. Under moist conditions spores, which have overwintered or have developed from overwintered mycelium, infect leaves causing the characteristic spots. On these dead spots the fungus produces many conidiophores bearing racquet-shaped, multicellular spores. These, when washed or blown to other leaflets, germinate rapidly if moisture be present and so the disease is spread throughout the season.

Other Hosts.

Alternaria solani may also attack the tomato.

Control.

The only method of control is consistent spraying with Bordeaux as for Late Blight.

(b) **Wilt or Fusariose.**

Luckily this disease, caused by *Fusarium oxysporum* Schlect, is not of serious economic importance here since the causal organism is best suited to sandy loam and a hot growing season. It is common in Pennsylvania, Ohio, Michigan, Indiana, South Dakota, etc., and it is sometimes severe in south-eastern New York. The fungus is to be found in our sandy-loam soils and potatoes are attacked but wilting to any marked extent does not often occur.

Symptoms.

In early stages of the disease the plant shows rolled, slightly yellowed foliage. The rolling can be differentiated from that in "Leafroll" because the leaves are not stiff and inclined to brittleness as in the latter disease. If the attack is slight rolling and yellowing of the leaves combined with a dwarfing of the plant may be the only symtoms until late in the season when such plants die down prematurely. If the invading organism develops more rapidly the lowest leaves yellow and fall and there is a tendency to "rosette-top" quite similar to that in the Rhizoctonia disease. Given optimum conditions for the fungus and the vines lose their lower leaves and wilt. In very severe cases a lesion may be obvious just below ground level but as a rule it is only on cutting through the stem that one can see the browned condition of the vascular

tissues. Sometimes only one or two haulms in a hill are affected but generally the whole plant shows the symptoms.

An inspection of the root system proves that root tips and feeding roots are rotted off and larger roots when sectioned are seen to have browned vascular tissues. Lesions occur on the stolons owing to attacks from the outside. The organism can grow from the affected stem or stolon into the vascular tissues of the tuber and here it gives rise to "net-necrosis". The necrosis of the vascular tissues of the tubers varies from slight, when it only penetrates a quarter of an inch from the stem, to severe when it may extend from the stem-end over half way through the tuber. In the latter case tuber rot may occur if moisture and temperature conditions during storage are suitable. In the former such tubers used for seed develop "spindling" sprouts.

Sources of Infection.

There are two sources of infection:—(1) the soil and (2) diseased seed-tubers. In the first case wilting does not usually occur until late in the season if it occurs at all, and this is the condition generally here. In the second case either the plants are so spindling that they cannot grow or wilting may occur earlier in the season when tubers are about half grown.

Resistant varieties.

Little is yet known of varieties actually resistant but it is important to notice that early potatoes escape the disease. Thus Irish Cobbler tubers are fairly mature by the time Fusariose becomes prevalent while Green Mountain tubers are just forming.

Control.

1. If the soil is known to be infested crop rotation must be practised and if the infestation is severe a long rotation of five or more years is necessary.
2. Tubers should be selected for soundness. All germinated tubers showing a tendency to "spindling sprout" should be discarded. If the tubers have not been sprouted the stem-end of suspicious tubers can be clipped and those with net-necrosis discarded, or the stem-end half only discarded if the bud end is healthy.
3. Plant disease-escaping varieties, i.e. early types.

(c) Common Scab.

In Europe, Africa, Australasia, and North America common scab occurs probably everywhere the potato is grown. The disease is caused by a fungus closely related to the higher bacteria and known as *Actinomyces scabies* (Thax.) Gussow. It is often present to such an extent as to prohibit potato culture but usually the chief loss comes from depreciation in the sale value of the tubers. Estimates show that there is a variation from 5 p.c. to 75 p.c. of the crop which is unfit for sale.

Symptoms.

This is a tuber disease and the symptoms vary from shallow, rough pittings if the attack occurred when the tubers were nearly mature, to deep rough pittings with furrows and cracks if the potatoes were infected when young. At first the scab appears as a minute red-brown spot. It gradually extends outward, becomes irregularly corky and deeper brown in color. Scab mites, white grub and wire worms enlarge and deepen the injury, making the tubers still less valuable.

Life History of the Organism.

The fungus lives overwinter in the scab spots on the tubers or in the soil. In the soil it may persist for many years and in that case long rotation is not sufficient but soil treatment must be considered. Alkaline soils favour the fungus and acid soils, check it. Thus the addition of lime, stable manure, potash or ashes to soil is dangerous when it is known that the scab organism is present.

Other Hosts.

Turnips, beets and mangels are susceptible to attack by this organism and therefore these crops cannot be used in a rotation.

Varietal susceptibility.

Irish Cobbler, Sir Walter Raleigh and Carmen among others are fairly resistant to scab.

Control.

Two essentials are clean seed tubers and clean soil. If the soil is clean great care should be taken regarding the seed tubers and when there is any doubt disinfection should be thoroughly performed. Even in the case of infected soil it is essential that clean seed tubers be used since otherwise the infestation is being increased. Long continued investigations

are demonstrating the value of sulphur as a medium for soil treatment. Martin in 1921 found that only 8.9 p.c. of clean tubers developed in infested, untreated soil but when 600 lbs. per acre of finely ground sulphur were applied there were 33.5 p.c. clean tubers and when 600 lbs. of inoculated sulphur were used per acre the clean tubers reached 50.9 per cent. This, it is to be remembered, is in soil severely infested with *Actimomyces scabies.* In some soils 600 lbs. of sulphur per acre might be disadvantageous while 300 lbs. would be satisfactory. By inoculated sulphur is meant sulphur having mixed with it soil containing sulphur oxidising bacteria.

(d) **Skin spot.** (*Oospora pustulans*).

Reference has already been made to the fact that skin-spot has been shown by Shapovalov to be a stage of Powdery scab. (See Sci. Agric., 2: 202, 1922.)

(e) **Silver scurf.**

Harz in 1871 first described this disease when it occurred in Austria and since then it has been found in Germany, Great Britain, Ireland and North America. It is caused by a fungus named *Spondylocladum atrovirens* Harz.

Symptoms

In its early stages silver scurf, under moist conditions, causes olive black patches to appear on the surface of the potato. These dingy patches are the conidiophores and spores of the fungus. The spots may be small, or may cover an area half an inch or more in diameter. Later in the season the surface layers are slightly raised by the abundant growth of mycelium in the cells below and at this time small, black, superficial sclerotia are formed. When washed the raised areas appear whitish or silvery, giving rise to the name "Silver scurf". Still later in the season these raised areas gradually become depressed owing to the death and collapse of infected cells. If the season is moist enough for rapid fungus growth the areas increase in extent until in severe infections the whole surface of the tuber is involved and the fungus penetrates more deeply into the tissues. As a result it is not unusual to find tubers which are entirely discolored and shrunken. Surface layers with sclerotia slough off and thus infect the soil.

Life History.

The fungus overwinters as sclerotia which are very minute. These may be on the surface of the potato or in the cells of the outer layers or in debris sloughed off into the soil. How long such sclerotia may live in a dormant condition is doubtful but given moist, warm environment and they germinate readily by conidiophores. Vegetative development is rapid and from spore to spore occupies a period of only four or five days under optimum conditions. The conidiophores are erect, dark-brown, and tall (120 microns) and the spores are borne in whorls on the upper parts of the conidiophores. The spores are dark brown, five to seven celled and apparently quite resistant to adverse conditions. It is thus possible that spores developed later in the season may over winter.

Control.

The ordinary methods of seed-tuber disinfection do not control this disease and the only suggestion at present efficacious is that of tuber selection.

Books Reviews

Farm Management, by R .L. Adams, (McGraw-Hill Book Co., New York, $4.00.)

"Farming is business. It is as much business as importing goods, selling merchandise, building ships, running a railroad, and handling a mine. Jointly with industry in general, farming is subject to business principles and reacts to economic influences. The present day farmer should recognise that as such he is also essentially a business man or else he must eventually succumb in competition with other business men."

The above paragraph opens the first chapter of this new volume on the subject of farm management. Throughout the entire discussion of the principles and details involved in the successful operation of farm lands, the importance of applying business methods is continually emphasized. The value of a training in the science of agriculture is not overlooked, but the futility of attempting to farm commercially with no other training than a scientific one is made quite obvious. The combination of scientific knowledge and business acumen is necessary if success is to be achieved.

The greater portion of the book is divided into two main parts. The first part deals with general considerations, selecting the farm, organizing the business, choice of equipment, the soil factor, the capital requirements, farm profits, farm management surveys, etc. The second part covers farm book-keeping, cost accounting, costs of production, marketing methods, market quotations, farm labour, farm tenancy, lease forms, farm law, etc. In these two divisions of the subject a tremendous amount of invaluable material has been embodied. The subject is fully covered. The chapters are written in an interesting style. Important references can be marked on almost every page.

Part 3, consisting of twenty pages only, discusses the personal aspect of the subject, and is especially applicable to the agricultural graduate stepping out into "a busy, somewhat exacting, and occasionally none too sympathetic business world."

A very complete index to the contents and to the numerous references in the text, is included in the volume.

The author is Professor of Farm Management at the University of California.

671 pages, 27 chapters, numerous illustrations.

The Dairy Farm, by A. Leitch. (Musson Book Company, Toronto, $2.00.)

There are few agricultural text books that can be directly applied to Canadian conditions. One feels disposed to criticise our trained and experienced Canadian agriculturists who stay modestly in the background, allowing our farmers to depend almost entirely, for their knowledge, upon books which are imported. Practical volumes — applicable to Canadian conditions — are sadly needed: books dealing with animal breeding, horticulture, poultry raising, rural engineering, grasses and grains, etc., which the progressive farmer and earnest student can always have at hand.

This new addition to Canadian agricultural literature is written in a manner which makes it particularly suitable for quick reading and for convenient reference. It contains the essential facts, and for practical information it serves as a handy, compact volume. Not only has the author outlined the various breeds of dairy cattle, their care and management, feeding, ailments and diseases, etc., but he has also discussed fully the business aspects of dairy farming—management and economics—giving the reader the advantage of the knowledge and experience gained recently as Head of the Department of Farm Economics at the Ontario Agricultural College.

232 pages, 17 chapters, well illustrated.

A Guide to the Poisonous Plants and Weed Seeds of Canada and the Northern United States, by R. B. Thomson and H. B. Sifton. (University of Toronto Press, $2.50.)

This volume, which has just been published, will be of special value to farmers (particularly stockmen), veterinarians and botanists. It fills an important gap in agricultural literature. Too little is known of the injurious effects of certain weeds and too little importance has been attached to their presence in fodder. The authors state in their preface. "The indefiniteness with which many statements have had to be made and the dearth of positive experimental work upon which to base conclusions have been keenly felt in the preparation of these pages." This statement indicates the existing need for much careful study of our poisonous plants and of their effects.

The volume is divided into four main parts. The first three parts deal alternately with (1) plants found in hay (2) plants found in pasture and (3) plants found in concentrated feed stuffs. The plants mentioned in these three sections are those to which fatalities may usually be attributed. The fourth part or section includes "plants that, although poisonous, rarely cause the death of animals." This division of the poisonous plants is an especially valuable feature of the book.

A "Symptoms Key to the Principal Poisonous Plants" is included as well as a glossary and index. Many excellent photographs and drawings, made for this volume, are embodied in the text.

The authors and publishers are to be congratulated upon the particularly convenient and attractive manner in which the volume has been arranged, printed and bound.

169 pages, 40 illustrations.

Radiator Cleaning Compounds

By G. L. Shanks, Professor of Agricultural Engineering, Manitoba Agricultural College, Winnipeg

Radiators are the most universally used type of cooling apparatus on all classes of tractor or portable internal combustion engines. The efficient and satisfactory operation of any engine so equipped depends to a marked degree upon the proper functioning of this important adjunct of the cooling system. The cooling system of ordinary engines must dispose of, by radiation, about 45 per cent. of the total heat of the fuel and by so doing keep the temperature of the cylinder walls within the limits set by the designer. Automobile and tractor engines operate more economically when the temperature of the cooling water nears the boiling point but when the water boils the cooling system can no longer function properly. Where radiators are used, therefore, they must be designed to suit the particular engine without much surplus cooling effect if temperatures giving economy are to be attained. It follows then that when the radiator becomes coated with scale or foreign matter its radiating capacity is reduced and trouble from overheating results.

Overheating is a trouble more common in tractors than in automobiles for three reasons, viz: (1) the tractor usually works at nearly its full load but the auto only occasionally does so, (2) the tractor radiators usually are designed to hold the temperature as high as permissible, (3) operators of tractors use more dirty water, partly through lack of good supplies and partly through carelessness.

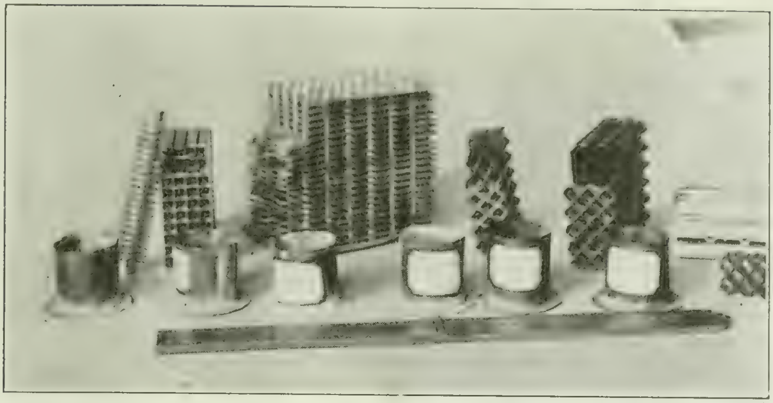
Deposits found in radiators include the following: rust particles, calcium and magnesium carbonates, calcium and magnesium sulphates, sand, clay, grease and such miscellaneous materials as leaves, straw and hair. The rust particles come chiefly from the iron of the engine itself and may be found in considerable quantity and usually to an extent sufficient to color all the deposits. The carbonates and sulphates are the result of using hard water. Some tractors will evaporate as much as twenty gallons per day and the importance of using pure water is readily seen. Very fine sand and clayey material is suspended in running water and sometimes in pond water and where such water is used for cooling purposes will form a part of the deposit. Grease may make its way into the radiator either from the water pump lubrication or by using oil cans for dipping water. Dirty containers for water or open radiator filling caps account for the presence of most of the miscellaneous materials. The net result of all these various deposits is that the radiator loses its efficiency and can no longer keep the engine sufficiently cooled for proper working. When this condition is reached (and many tractor operations in the Red River Valley have reached it in one season) it is necessary either to clean out the deposits or purchase a new radiator. Several different cleaning methods have been widely recommended in the past and with a view to finding out the safest and most effective treatment a brief investigation was commenced last July and recently completed.

The experiments were carried out in two distinct phases. The cleaning solutions were applied to small copper cups made by soldering sheets from an old flat tube radiator with a view to determining their relative corrosive effect. Next a second set of similar cups were coated thickly with scale by evaporating to dryness a quantity of Red River water and then applying the cleaning agents as directed. It will of course be recognized that the results obtained in this way are only relative and could not be taken to represent the actual proportions in radiators.

The following were the treatments tested, all being recommended by commercial firms or taken from the handbooks on tractor operation.

Treatment No. 1. Take a solution of muriatic acid and water in equal parts. Heat it. Fill the radiator and run for five minutes. Drain and flush radiator. Repeat if necessary.

Treatment No. 2. Put a solution of one part muriatic acid to six parts of water in the radiator cold. Leave for fourteen hours.



THE CUPS USED AND SAMPLES OF RADIATORS STUDIED.

Treatment No. 3. Dissolve half a pound of lye in five gallons of water. Put in radiator and run engine five minutes. Drain and flush; repeat several times if necessary.

Treatment No. 4. Dissolve half a pound of washing soda in four gallons of water. Use similarly to lye treatment.

In applying these treatments to the cups made from the old copper radiators all scale was first removed by the use of sand paper in order that the corrosive effect might be obtained by weighing the cups before and after each treatment. The results of the first series of tests were as follows:—

Treatment No. 1	Less of weight
First five minutes	10.7%
Second five minutes	0.05%
Third five minutes	1.6%
Fourth five minutes	1.9%

After the fourth treatment the solder was dissolved to such an extent that the cup fell apart.

Treatment No. 2:

This was applied in fourteen hour periods and also in seven minute periods.

	Loss of Weight
First fourteen hours	3.8 %
Second fourteen hours	1.1 %
Third fourteen hours	0.60%
Fourth fourteen hours	0.62%
First seven minutes	1.2 %
Second seven minutes	0.37%
Third seven minutes	0.42%
Fourth seven minutes	0.38%

The cups were intact after four treatments.

Treatment No. 3.	Loss of Weight
First five minutes	0.52%
Second five minutes	0.29%
Third five minutes	0.19%
Fourth five minutes	0.18%

Treatment No 4.	Loss of Weight
First five minutes	0.05%
Second five minutes	6.7%
Third five minutes	0.07%
Fourth five minutes	0.06%

In all of the above treatments it will be noted that the first treatment caused much greater loss of weight than subsequent treatments did. This is due to the fact that the cups were washed clean for the first treatment but after the first treatment were covered with the products of corrosion.

From a study of the above data it will be seen that treatment No. 1 is a very violent one and should not be applied except as a last resort. The succeeding three methods are more moderate in their action and should not damage a well constructed radiator.

As a second part of the experiment these cleaning solutions were applied to a second set of cups sealed up by Red River water. The results are briefly as follows:

Treatment No. 1: removed the scale completely in five minutes.

Treatment No. 2: removed nearly all the scale in seven minutes while time recommended is fourteen hours.

Treatment No. 3: applied three times and flushed each time, did not remove any appreciable amount of the scale, although it loosened it somewhat.

Treatment No. 4: resulted similarly to No. 3, but the scale was slightly looser.

To check up on the above results the leading manufacturers of radiators were circularized and five firms replied as follows:

Two recommended muriatic acid in varying strengths.

One recommended periodic use of washing soda.

Two wrote claiming that their radiators were immune from such trouble.

To sum up the results of our experiments so far, we believe that the following practices will give good results:

(1) Use as clean water as possible — rain water preferred.

(2) Use the washing soda solution periodically — at least once a month to keep deposits loosened.

(3) Use 1-10 muriatic solution cold for 12-14 hours at least once per season or when necessary.

The accompanying photo shows the cups used and samples of radiators studied.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

Dominion Elections

The results of the recent election for the four named officers of the Society for 1922-23 are as follows:—

President, J. B. Reynolds (by acclamation)

Vice-Presidents, H. Barton, representing English-speaking members; Jules Simard representing French-speaking members.

Hon. Secretary-Treasurer, L. H. Newman.

The ballots were opened on May 1st. 360 members voted.

Every possible effort is being made to ensure the complete success of the Annual Convention, which is being held at Macdonald College during the last week of June. The Convention will last for five full days, and during that time a complete course of at least twenty post graduate lectures will be given in animal production, plant industry, entomology and agronomy. This will give the members something worth while to take away from the Convention. The course of lectures is being given through the courtesy of the Dominion Department of Agriculture.

Business sessions will mostly be held in the morning, and post graduate lectures in the afternoon. Several evenings will be free. There is no desire to overcrowd the programme, as it is considered highly desirable to provide time in which groups of visitors may meet together in an informal manner.

The Convention will close officially on Friday June 30th, but as the following day is Dominion Day, a special programme is being arranged of a social nature, including a Dominion Day Banquet in Montreal. Members should therefore plan on attending the Convention for the entire week, commencing June 26th.

It will not be possible to announce the detailed programme before the end of May. In the meantime, reservations should be made through the General Secretary. Accomodation is being provided at Macdonald College for $2.50 per day, including room and meals. Any member who has definitely decided to attend the Convention will facilitate arrangements if he will make his reservation immediately.

APPLICATIONS FOR MEMBERSHIP

S. G. Carlyle, Live Stock Commissioner, Edmonton, Alta.

J. W. Eastham, (Edinburgh, 1899, B.Sc.) Provincial Plant Pathologist, Vancouver, B.C.

H. J. Maybee (O.A.C. 1921, B.S.A.) Woodstock, N.B.

J. E. Meagher (Alberta, 1921, B.S.A.) Artland, Sask.

J. E. McLarty (O.A.C. 1916, B.S.A.) Denholm, Sask.

NOTES

A. H. MacLennan (O.A.C. '08) has been appointed Professor of Horticulture at the Ontario Agricultural College, to succeed J. Warren Crow.

R. S. Kennedy (Macdonald '12) has resigned from his position with the Soldiers' Civil Re-establishment Department at Ottawa, where he has been in charge of district vocational training for the past three years. He is now engaged with the Advertising Department of the Montreal Star.

E. C. Hatch (Macdonald '20) is taking up farming at Brockville, Ontario, on May 1st. He intends to specialize in small fruits and poultry. For the past two years Hatch has been with the Advertising Department of the United Farmers Guide.

Dr. A. T. Charron, Director of the Dairy School at St. Hyacinthe, P.Q., sailed from St. John on April 22nd, and will be one of the two Canadian representatives to attend the International Conference of World Agriculturists, to be held at Rome in May. Dr. Charron is a member of the Dominion Executive of the C. S. T. A. and a past President of the Montreal Branch.

BRANCH CONSTITUTIONS

It is highly important that the various branches of the Society should adopt Constitutions and By-laws that are as nearly uniform as possible. The dates of annual meetings, for instance, should coincide in all provinces, so that new officers, delegates, etc., are elected at approximately the same time. At present annual meetings are held at dates varying from February to June.

In the present issue we have published the Constitution and by-laws of the British Columbia Branch, for the reference of other branches, having in mind that, with minor changes, it might be generally adopted.

Constitution of British Columbia Branch

(Revised and amended, April, 1922.)

Article 1. NAME.

The organization shall be known as the British Columbia Branch of the Canadian Society of Technical Agriculturists. (B.C. Branch of the C. S. T. A.)

Article 2. OBJECTS.

The objects of the branch shall be those enumerated in the Constitution of the Dominion Society.

Article 3. MEMBERSHIP.

The membership and eligibility requirements within the branch shall be the same as stipulated for the Dominion Society.

Article 4. OFFICERS.

The officers shall be a President, Vice-President and Secretary-Treasurer, who together with three (3) other members shall form the executive of the branch.

One member of the branch executive shall be elected by the executive to represent the Province on the Dominion Executive, and shall be a delegate to the Annual Convention.

Article 5. MEETINGS.

There shall be an annual meeting of the branch and this shall be held at time and place as decided by the members at the previous annual meeting.

Other meetings of the branch, or its executive, shall be arranged as may be found advisable to further the objects of the branch and of the society as a whole.

Quorums. — As stated in Constitution of C. S. T. A. p. 16.

Article 6. FEES.

The amount of the annual fees payable within the branch shall be regulated by By-laws.

Article 7. ELECTIONS.

The officers and members of the executive as well as two auditors, shall be elected as may be provided for in the By-laws.

Article 8. ORDER OF BUSINESS.

The order of business at all meetings of the branch and its executive shall be as follows:—

A. Minutes.
B. Business arising out of minutes.
C. Correspondence.
D. Reports of committees.
E. Unfinished business.
F. Election of officers and committees.
G. New business.
H. Resolutions.

This order may be varied at any meeting by a two-thirds vote of the members present.

Article 9. CHANGE OF CONSTITUTION.

This constitution may be amended at any meeting of the local branch by unanimous vote, or by a majority vote at two consecutive meetings.

BY-LAWS.

Article 1. MEMBERSHIP.

In regard to membership the same regulations apply to the branch as are at present adopted by the Dominion Society.

Article 2. DUTIES OF OFFICERS AND DELEGATES.

(Clause a): — The President and other officers shall perform the usual duties of their respective offices.

(Clause b). — 1. The delegates elected by the branch to attend the Annual Dominion Convention shall prepare and submit to the Branch Executive a written report based upon the discussion arising from the resolutions and recommendations submitted by the delegates from the branch to the Dominion Convention.

2. The Secretary-Treasurer shall mail a copy or a summary of the Delegates' report to each member of the Branch within two (2) months of the date of the annual Dominion Convention.

Article 3. ORGANIZATION.

This local branch constitutes itself as the Provincial branch for B. C.

Article 4. MEETINGS

(Clause a). — Notification of the place, date and agenda,, apart from those of a routine nature, for general meetings shall be sent by mail to each member in good standing at least three weeks in advance.

(Clause b). — At the written request of not less than ten (10) members of the Provincial Branch, the Secretary shall call an Extraordinary General Meeting, and at least three weeks' notice of such meeting shall be given to members in good standing.

Article 5. FEES.

The membership fee for the branch shall be $10.00 per annum payable to the Provincial Secretary-Treasurer, at or before the first of May each year.

Article 6. ELECTIONS.

1. Nominations shall be made by a Nominating Committee consisting of three members of the branch appointed by the Annual General Meeting. This committee shall receive nominations for Officers and Delegates and shall prepare the ballots to be submitted to the members of the Branch; and they shall submit such ballot to the Branch Executive at least one month before the next Annual Meeting.

2. The nominating committee shall accept, as valid, any other nominations if signed by three members in good standing, providing they are received by the committee or the Secretary-treasurer one month before the Annual Meeting of the Branch.

3. The secretary-treasurer shall obtain the assent or dissent of all candidates for election as Officers, Delegates or Committeemen before issuing the ballots containing the names of such candidates to the members to be voted upon.

4. The election shall be conducted by letter ballot, every regular member in good standing being entitled to cast one ballot.

5. The secretary-treasurer shall mail a copy of ballot to each member as provided for in Article 4, section 1 of the By-laws.

6. All letter ballots shall be returned to the secretary-treasurer at or before the hour of the Annual General Meeting.

7. Any vacancy on the Executive occurring during its term of office may be filled by the Executive.

Article 7. COMMITTEES.

The branch or the executive may appoint such committees from time to time as may be considered necessary.

Article 8. AUDITORS.

Auditors shall be elected each year at the annual convention to audit the books and accounts of the society during the ensuing year.

Article 9. AMENDMENTS TO BY-LAWS.

The By-laws of the branch may be amended or added to by a majority vote of the members present at the annual meeting or through unanimous decision by the Provincial executive, subject to approval at the next annual meeting, provided that in the first case the proposed amendment has been included in the agenda for the meeting.

The Mode of Inheritance of Certain Characters in Wheat

J. B. Harrington *

Gradute Student, University of Minnesota **

The results described in this paper were obtained from a small portion of the cereal breeding nursery material grown in 1921 on the University of Saskatchewan Experimental Farm at Saskatoon. The general mode of inheritance of the wheat characters here discussed has been made known through previously published studies. The results

Table I.—Description of Parent Varieties

Variety Name	Abbreviation used.	Country of origin.	Presence or absence of awns	Chaff colour	Seed colour	Seed texture: Percentage	Seed texture: Class
Taylor's Wonder	T. W.	Canada	Tip-awned	White	White	49	Semi-hard
Commonwealth	Com.	Australia	Tip-awned	Red	Red	33	Soft
Marquis	Mar.	Canada	Tip-awned	White	White	88	Hard
White Bobs	W. B.	Australia	Bald	White	White	90	Hard
Kitchener	Kit.	Canada	Tip-awned	White	Red	87	Hard
Red Bobs	R. B.	Canada	Bald	White	Red	75	Hard
Hard Red Calcutta	H. R. C.	India	Bearded	White	Red	82	Hard

Table II.—The Inheritance of Seed Colour

Crosses, with 1919 numbers	F_2 plants seed colour: Red	F_2 plants seed colour: White	Actual ratio per 4 or 16	Deviation from expected results	Probable error of each term	Dev. / P.E.
R. B. x T. W. Nos. 71, 77, 78	71	33	2.73:1.27	0.27	±0.11	2.45
H. R. C. x W. B. Nos. 113, 114	72	29	2.68:1.32	0.32	±0.12	2.67
Kit. x Com. No. 90	36	4	14.40:1.60	0.60	±0.41	1.49
R. B. x T. W. Nos. 72-76	181	14	14.85:1.15	0.15	±0.19	0.74
H. R. C. x T. W. No. 80	47	2	15.35:0.65	0.35	±0.37	0.94
H. R. C. x W. B. Nos. 109, 110, 112, 115	111	8	14.92:1.08	0.08	±0.24	0.33

* Formerly lecturer in field husbandry at the University of Saskatchewan.

** The writer wishes to thank the Field Husbandry Department of the University of Saskatchewan for the wheat material furnished and Dr. H. K. Hayes for helpful criticisms made during the preparation of the manuscript.

Note 1. The material which furnished the data given in Table II resulted from cross-pollinations made on six spikes of wheat in 1919. Each hybrid seed produced an F_1 plant in 1920 and this, in 1921, gave an F_2 family. The F_2 families arising from the same cross-pollinated spike are grouped together.

Note 2. The formula used for the determination of probable error is

$$\text{P. E.} = \pm\ 0.6745 \sqrt{\frac{N\ (K-N)}{n}}$$

where N = a particular term of a Mendelian ratio, K = the sum of all the terms of such ratio, and n = the total number of individuals classified.

presented are of interest since well-known Canadian wheats were used in the experiments.

The data were obtained from the second generation of crosses made in 1919 as follows:

Red Bobs x Taylor's Wonder
Hard Red Calcutta x Taylor's Wonder
Hard Red Calcutta x White Bobs
Commonwealth x Kitchener.

A total of 652 plants belonging to 43 second generation (F_2) families were studied in detail with respect to seed colour, seed texture, chaff colour, and awn character. A description of each parent variety is given in Table I. These descriptions apply only to material grown in the season of 1921 in close proximity to the F_2 progeny.

Inheritance of Seed Colour

Seed colour inheritance in wheat has been studied for a number of years. Biffin (1), in 1905, found that crosses between red-seeded and white-seeded wheats produced red-seeded and white-seeded plants in a 3:1 ratio in F_2. He also noticed that dark red appeared to be dominant to light red. In 1911, Nilsson-Ehlė (7) reported crosses which, in the F_2, produced 3:1, 15:1, and 63:1 ratios of red-seeded and white-seeded plants, respectively. The Howards of India (8), in 1912, obtained 63:1 ratios of red to white in crosses of red Indian wheats with American white clubs. Gaines (5), in 1917, found 3:1, 15:1, and 63:1 ratios of red to white. He distinguished at least three different shades of red and decided that the degree of red depended upon the number of factors present. White, being due to the absence of any red pigment, was considered to be the result of homozygous recessiveness of all factors.

The results obtained for seed colour inheritance in the present study are given in Table II.

No attempt was made to differentiate the various reds. The ratio of red-seeded to white-seeded plants in the F_2 approached 3:1 in some cases and 15:1 in others. From this it is apparent that some of the red-seeded wheats used have one factor for seed colour and others have two.

In order to obtain a measure of the reliability of the results it is necessary to know, first, the deviation of each term of the actual ratio of observed results from the corresponding term of the theoretical (expected) ratio, and second, the relationship of this deviation to the probable error of the given term. When a deviation is no greater than the probable error there is a 1:1 probability that it is due to chance, but a deviation of three times the probable error would occur only once in 22 times by the laws of chance. For the purpose of determining the significance of the terms of the ratios in this paper, deviations amounting to less than three times the probable error were not considered serious. The deviations for the 3:1 ratios in Table II are rather high yet not large enough to be significant.

It is of interest to note that in the crosses of Red Bobs x Taylor's Wonder part of the F_2 families segregated in a 3:1 ratio for seed colour and part in a 15:1 ratio. It therefore appears that the red-seed parent included two apparently similar strains which differed in their genetic constitution for seed colour, one having a single factor for red and the other having two factors. These two types of segregation were also produced in the Hard Red Calcutta x White Bobs crosses. The genetic constitution for seed colour of a pure line of wheat having two factors for red would be $R\ R\ R_1\ R_1$ and where only one factor was concerned, it would be $R\ R\ r_1\ r_1$ or $r\ r\ R_1\ R_1$. Pure line white wheats would be in all cases homozygous recessives for seed colour with the constitution $r\ r\ r_1\ r_1$. Since seed colour factors in wheat are evidently inherited independently a cross between two red varieties of the constitutions $R\ R\ r_1\ r_1$ and $r\ r\ R_1\ R_1$ should produce red-seeded and white-seeded plants in the ratio of 15:1 in the F_2. This is precisely the result obtained by Nilsson-Ehle.

Inheritance of Seed Texture

Until recently very little study had been made of the inheritance of seed texture in wheat. In 1915, the Howards (9) found an intermediate condition in the F_1 when a vitreous kerneled wheat was crossed with a starchy variety. The F_2 gave a 1:2:1 ratio of soft, intermediate and hard. Biffin (2), in 1916, obtained a 3:1 ratio in F_2 of soft and hard-seeded plants from a cross between a hard-seeded trugidum wheat with a soft Polish variety. Freeman (4), in 1918, secured hard, intermediate and soft-seeded plants, from crosses between hard-seeded durums and a soft club. After carrying the experiment through the fourth generation he

concluded that there was incomplete dominance of softness, two factors being present and giving six degrees of starchiness for grain texture, owing to the endosperm being the result of double fertilization and the effect of the factors cumulative.

secured similar results in 1918. The Howards (9), in 1915, found upon crossing a bearded with a tip-awned wheat, that the F_1 displayed an intermediate condition as manifested by very short awns. The F_2 segregated into tip-awned, intermediate, and fully awned (bearded) in a 1:2:1 ratio. They also observed that when a bald wheat was crossed with a bearded wheat the inheritance of awned character appeared to be governed by two factors. To explain their results they supposed that bearded wheats had two factors, B and T, in a homozygous condition; that tip-awned wheats, like Marquis or Red Fife, had either B or T in a homozygous condition; and that bald (awnless) wheats lacked both factors.

Table III.—Inheritance of Seed Texture in F_2

Cross or parent	Percentage texture 30	35	40	45	50	55	60	65	70	75	80	85	90	Total
R. B.							2		1	1	1	3		8
T. W.			1	1	2		1							5
R. B. x T. W. . .			10	43	46	43	36	42	29	20	19	10	2	300
H. R. C.										2	3	4	1	10
T. W.			1	1	2		1							5
H. R. C. x T. W.				7	5	7	8	6	11	4	1			49
Kit											1	1	3	5
Com.	4		2											6
Kit. x Com.. . .		1	6	7	5	4	10	4	1	2				40

The data on seed texture is summarized in Table III. Texture is represented on a scale of 30 to 90, 30 standing for soft starchy seed and 90 indicating hard vitreous seed. The distribution for Red Bobs x Taylor's Wonder approximates that of the parent varieties but the number of parent individuals classified was too small to approach a normal curve of probability. The distribution for Hard Red Calcutta x Taylor's Wonder and for Commonwealth x Kitchener approaches the extremes of the parents. The range for each of the parents probably would have been more extensive had a larger number of individuals been used. The general evenness of the distribution through various grades of texture between soft and hard would seem to indicate that seed texture in wheat is dependent on several factors.

Inheritance of Awn Character

Various investigators have studied the inheritance of awns in wheat. In 1905, Biffin (1) obtained a 3:1 ratio of tip-awned and bearded plants in F_2. Kezer and Boyack (1)

In Table IV a summary is given of the data on awn character obtained in the present study. A cross between Red Bobs (bald) and Taylor's Wonder (tip-awned) yielded in the F_2 230 tip-awned and 69 bald, or a ratio of 2.92 : 1.08. This is very close to a 3:1 ratio and indicates the presence of one factor. With a single factor difference the F_2 should contain three classes of individuals, homozygous bald, heterozygous tip-awned and homozygous tip-awned. As it is difficult to separate individuals of the last two groups it was thought best to leave them together, especially as the number of individuals classified was not large.

Table IV.—Inheritance of Awns in F_2

Cross	Tip awned	Bald and tip-awned	Bearded	Bald	Actual ratio per 4 or 16	Deviation from expected ratio	Probable error of each term	Dev. / P. E.
R. B. x T. W. . .	230	. . .	. .	69	2.92:1.08	0.08	±0.07	1.14
H. R. C. x T. W...	38	. . .	11	. .	3.10:0.90	0.10	±0.17	0.59
H. R. C. x W. B.	. . .	204	16	. .	14.83:1.17	0.17	±0.08	2.12

Table V.—Factor Hypothesis for Awn Inheritance in the Cross Hard Red Calcutta x Taylor's Wonder

Phenotype	Bald	Almost bald	Short tip-awned	Long tip-awned	Bearded
Genotype	bbtt (1)	bbTt (2) Bbtt (2)	bbTT (1) BBtt (1) BbTt (4)	BbTT (2) BBTt (2)	BBTT (1)
F_2 plants	27	48	87	42	16
Observed ratio	1.98	3.47	6.33	3.05	1.16
Expected ratio	1	4	6	4	1
Deviation	0.98	0.53	0.33	0.95	0.16
Probable error	±0.18	±0.32	±0.35	±0.32	±0.18
Dev. ÷ P. E.	5.44	1.63	0.94	2.96	0.89

A cross between Hard Red Calcutta (bearded) and Taylor's Wonder produced, in the F_2, 38 tip-awned plants and 11 bearded. Here again a single factor difference is indicated and the F_2 should contain three classes of individuals, homozygous bearded, heterozygous tip-awned, and homozygous tip-awned. For reasons already mentioned the two tip-awned classes were not separated.

The cross between Hard Red Calcutta and White Bobs produced, in the F_2, a series of forms which could be grouped with some difficulty into bearded, long tip-awned, short tip-awned, almost bald and bald. If all the bald and various tip-awned plants are placed in one group and the bearded plants in another a ratio of 15:1 is obtained and the presence of two factors indicated. Considering then that the bearded parent contains two factors, BBTT, the bald parent would be represented by bbtt and a cross between the two would produce the parental combinations, and in addition, two homozygous tip-awned types, BBtt and bbTT, and several heterozygous types with various grades for intermediate development of awned character.

In Table V the results for the Hard Red Calcutta x White Bobs cross are placed in five groups. The expected ratio of 1:4:6:4:1 is on the basis of the genotypes which are presumed to be represented in the various groups. The observed results were 27, 48, 87, 42, 16, respectively, giving a ratio of 1.98 : 3.47 : 6.33 : 3.05 : 1.16. The agreement on the whole is remarkably close considering the difficulty of classifying some of the tip-awned plants. The only serious divergence is in the bald class where the deviation is over five times the probable error. A deviation of five times the probable error stands a 1310 : 1 chance of being significant. Possibly this deviation is due largely to the difficulty of correctly distinguishing between bald and almost bald spikes, resulting in too many individuals being placed in the bald class. The Howards (9) drew attention to the liability of such an error. It will be noticed that the BBtt, bbTT and BbTt genotypes are placed in one class in the table. It is frequently possible to separate these into three classes on phenotypic appearance (6 and 9) but it was not thought advisable here.

The factor grouping for presence or absence of awns in the parent varieties and in the F_2 material may be summarized as follows:

Variety	*Phenotype*	*Genotype*
Hard Red Calcutta	fully bearded	BBTT
Taylor's Wonder	Tip-awned	BBtt or bbTT
White Bobs	bald	bbtt
	fully bearded	BBTT
	long tip-awned	BbTT
	long tip-awned	BBTt
	short tip-awned	bbTT
F_2 generation	short tip-awned	BBtt
	short tip-awned	BbTt
	almost bald	Bbtt
	almost bald	bbTt
	bald	bbtt

Now, since some tip-awned varieties may have the factors BBtt and others may have bbTT, a cross between one of each type should produce individuals ranging from bald to bearded in a 1:4:6:4:1 ratio. Possibly the infrequent occurrence of this result in breeding work (2) is due to the fact that most of our tip-awned varieties are of the same genetic constitution with respect to awn character.

The results described in this paper on the inheritance of awn character in wheat agree with those obtained by the Howards (9). They made a number of crosses between bald, tip-awned, and bearded wheats and attempted to separate the F_2 progeny into nine classes according to the nine genotypes present. By carrying their material through the F_3 generation they were able to prove the accuracy of the F_2 classification. They found that BBtt produced a different tip-awned condition than bbTT. The explanation given is that one of the two factors produces very short awns and the other fairly long awns.

The Inheritance of Seed Colour and Awns

Table VI shows the mode of inheritance of awn character with respect to seed colour. Red Bobs x Taylor's Wonder, Numbers 71, 77 and 79, gave a 3:1 ratio for seed colour as well as for awn character. A 9:3:3:1 ratio is obtained when these two characters are considered together. Red Bobs x Taylor's Wonder, Numbers 72 to 76, gave a 3:1 ratio for awn character but a 15:1 ratio for seed colour, consequently a 45:15:3:1 is produced when both characters are taken into account. Similarly in Hard Red Calcutta x White Bobs, Numbers 113 and 114, a 45:15:3:1 ratio is obtained. In this case segregation for seed colour was in a 3:1 ratio and for awn character in a 15:1 ratio. Hard Red Calcutta x White Bobs, Numbers 109, 110, 112 and 115, produced a 15:1 ratio for both seed colour and awn character. Considering the characters together gives a 225:15:15:1 ratio. The results in general agree unusually well with the theoretical expectations.

Inheritance of Chaff Colour

Biffin (1), in 1905, found that both red chaff and gray chaff were dominant to white chaff, the ratio being 3:1 in F_2. Kezer and Boyack (10) reported a 3:1 ratio for red and white chaff in 1918. At about the same time Love and Craig (11) obtained an indication of a 15:1 ratio for red and white chaff in the F_2 of a durum x vulgare cross.

In the present study only a small amount of material of one cross was available for classification. The parents of the cross were Commonwealth, an Australian wheat

Table VI.—Inheritance of Awns and Seed Colour

Crosses	Seed colour	Awns	F_2 plants	Actual ratio	Expected ratio	Deviation	Probable error
R. B. x T. W. Nos. 71, 77, 79	Red	Tip-awned	50	7.70	9	1.30	±0.53
	Red	Bald	21	3.23	3	0.23	±0.41
	White	Tip-awned	22	3.38	3	0.38	±0.41
	White	Bald	11	1.69	1	0.69	±0.26
R. B. x T. W. Nos. 72-76	Red	Tip-awned	146	47.92	45	2.92	±1.41
	Red	Bald	35	11.49	15	3.51	±1.31
	White	Tip-awned	12	3.93	3	0.93	±0.65
	White	Bald	2	0.66	1	0.34	±0.38
H. R. C. x W. B. Nos. 113, 114	Red	Bald and tip-awn	69	44.16	45	0.84	±1.97
	White	do	27	17.28	15	2.32	±1.83
	Red	Bearded	2	1.28	3	1.72	±0.91
	White	do	2	1.28	1	0.32	±0.54
H. R. C. x W. B. Nos. 109, 110, 112, 115	Red	Bald and tip-awn	99	211.22	225	13.78	±5.14
	White	do	9	19.20	15	4.20	±3.70
	Red	Bearded	12	25.58	15	10.58	±3.70
	White	do	0	0.00	1	1.00	±0.98

Table VII.—Inheritance of Chaff Colour in the Cross Commonwealth x Kitchener

Chaff colour	F_2 plants	Actual ratio	Expected ratio	Deviation	Probable error	Dev. P. E.
Dark red	12	1.20	1	0.20	±0.19	1.05
Light red	18	1.80	2	0.20	±0.21	0.90
White	10	1.00	1	0.00	±0.19	0.00

with dark-red chaff, and Kitchener, a Canadian variety with white chaff. The data, as shown in Table VII, distinctly brings out the dominance of red glume colour over the absence of colour. Of 40 individual plants, 12 had dark red chaff, 18 light red, and 10 white, a very good 1:2:1 ratio.

Summary

1. The number of factors for seed colour was found to vary with the different varieties and with different strains of the same variety. Segregation for seed colour occurred in both 3:1 and 15:1 ratios, red being dominant to white. Kitchener has two factors for seed colour but Hard Red Calcutta and Red Bobs have one in some selected lines and two in others.

2. Seed texture appeared to be governed by several factors. The distribution in F_2 approximated the extreme range of the parent varieties.

3. Two factors appeared to be concerned with the production of fully awned spikes. In the F_2 of a cross between Hard Red Calcutta, a bearded variety, and White Bobs, a bald variety, four homozygous forms resulted, two having the parental combinations BBTT and bbtt, and two, represented by BBtt and bbTT, being tip-awned. In addition there were several heterozygous forms intermediate between the parent sorts; those with one factor heterozygous, represented by BBTt and BbTT giving long tip-awns, and by Bbtt and bbTt giving short tip awns; those with two factors heterozygous, of the constitution BbTt, with fairly short tip awns. The material studied was placed in five groups, bald, almost bald, short tip-awned, long tip-awned, and bearded. The factors found to be present in the varieties used may be designated as follows:

Hard Red Calcutta	BBTT
Taylor's Wonder	BBtt or bbTT
White Bobs	bbtt

4. A single factor was responsible for red colour of chaff in the cross studied. Segregation occurred in a 1:2:1 ratio of dark red, light red and white.

Literature Cited

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Diseases of the Potato

By B. T. DICKSON,

Professor of Botany, Macdonald College

(Group 7 Continued.)

(f) Dry rot of tubers.

Heavy losses in stored potatoes sometimes occur in those years when Late Blight does not appear to be an important factor. Such losses are mainly due to tuber rots caused by species of *Fusarium*. It is difficult accurately to ascertain the extent of such losses but they take a heavy annual toll from growers and dealers.

Fig. 13. — Original photograph from material collected at Macdonald College, September 21st, 1921. The minute sclerotia on the inside and outside of the affected stems are shown.

Symptoms

The rot usually starts from a wound which penetrates the tissues or which may be merely an abrasion of the skin. At first the affected tissues are firm and cheesy and the fungus produces white or pink tufts of mycelium, conidiophores and conidia on the surface. As the diseased part increases in area and depth the tissues dry out, shrivel and eventually become quite hard. Under warm, humid conditions the rot develops more rapidly and is softer at first but finally the tuber becomes shrunken and hard. If *Fusarium* species only are present there is no foul odour but usually bacteria are to be found associated and hence the rot may be softer and malodorous.

Causal organisms

Fusarium discolor sulphureum is probably the chief cause of dry rot but *F. oxysporum* may penetrate so far into the tuber tissues that it also gives rise to storage rot. Other species of *Fusarium* occasionally cause similar rots but they are not usually so serious.

Relation to Late Blight Rot

The rot caused by *Phytophthora infestans* when severe is seen at digging time and the heaviest losses begin to show soon thereafter in storage but *Fusarium* rots inflict heaviest losses in the later storage period. It is obvious, however, that small lesions caused by *P. infestans* are eminently suitable as points of entrance for *Fusaria* and infection by *Fusaria* commonly occurs. The rot is then not "dry" as in the case of infection by *Fusarium* alone.

A feature of importance is the amount of rot in storage which occurs in certain years even after consistent spraying with Bordeaux is practised. Murphy (Ottawa Bull. 44) has mentioned this and I have had many requests for information from Quebec farmers. During a warm wet autumn the sprayed plants remain green and continue to grow well on to harvest. At digging time the tops are still green and under such conditions some Late Blight is almost sure to be present. Spores fall on moist tubers and infection may occur which does not manifest itself until later in storage. Even if no Late Blight be present the tubers are immature so far as their skins are concerned and therefore are easily injured. Through these injuries *Fusaria* enter and in the spring there is the likelihood of heavy loss from dry rot. It would probably be better to cut the tops some seven to ten days before digging to remedy this, and experiments are under

way to determine the efficacy and economy of such a procedure.

Storage Conditions

Moist warm storage is suitable for the rapid spread of dry rot (and other storage rots) and it is therefore important to be able to ventilate well and to maintain a temperature about 35° F., or slightly lower so long as the freezing point is not reached.

Fusaria can live over the summer on refuse in the corners and on the walls of bins, and clean bins are essential to safety.

Effect on plants

If infected tubers are used for planting the rot may continue so that no plant develops or the shoots are weak and spindling. It is entirely inadvisable to use even doubtful seed.

Control

1. Avoid injury to tubers as much as possible.
2. Use cleaned and disinfected bins.
3. Keep the storage places cool (35° F.), well-ventilated, and dry.
4. Avoid digging tubers for storage with immature skins.
5. Plant healthy seed tubers.

(f) Net-necrosis

The term "net-necrosis" was first used by Orton in 1914 to describe a discoloration of the vascular tissues of the tubers. The color varies from brownish to black and it may appear in the stem-end only or extend throughout the tuber. There are now three accepted types of net-necrosis, viz:—*Frost net- necrosis, Fusarium net- necrosis* and *Leafroll net-necrosis.* It is also suggested that a net-necrosis may be caused by adverse soil or growing conditions.

In any of these cases it is inadvisable to use such tubers for seed purposes since they will develop spindling plants.

The net-necrosis under consideration is that which is the result of Fusarium infection, usually *F. oxysporum.*

Symptoms

The discoloration of the vascular tissues varies from a slight browning at the extreme stem-end to an intense darkening two-thirds or more through the tuber. In very severe cases the discoloration may extend to the bud-end but usually the distal half of the tuber is free from any symptoms. There are all gradations between these extremes. Slices cut across the stem-end show that not only the vascular elements of the ring but also the secondary vascular strands in the cortex and medulla are affected.

On cutting successive slices it is seen that the discoloration becomes less intense as the bud-end is approached and that it is more confined to the vascular ring and cortex and later to the ring only. Gradually the discoloration disappears and slight water-soaking in the vascular ring is the last symptom towards the bud-end. By paring the tuber down to the vascular ring the network of discolored tissues is easily seen. Externally, affected tubers appear to be sound but occasionally the blackened bundles at the stem-end may show through the skin.

Effect on Plants

Such tubers used for seed purposes give rise to spindling plants, the weakening of the plant depending on the extent of vascular

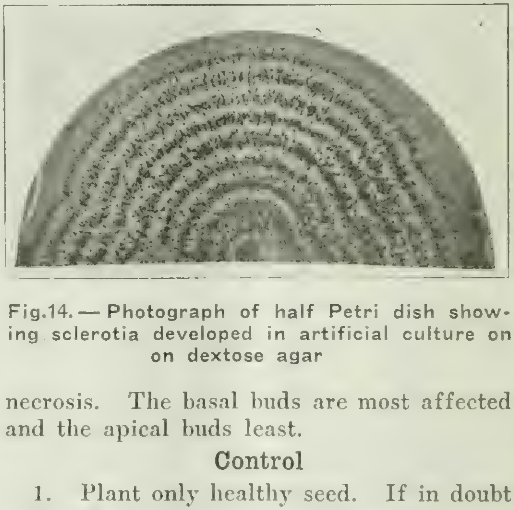

Fig.14.— Photograph of half Petri dish showing sclerotia developed in artificial culture on on dextose agar

necrosis. The basal buds are most affected and the apical buds least.

Control

1. Plant only healthy seed. If in doubt slice off the stem-end and discard tubers showing strong discoloration.
2. Sprout tubers before planting and discard those with weakly sprouts, or if apical sprouts are strong while basal sprouts are spindling cut off and discard the stem-end.
3. It is probable that dusting the cut surface with finely ground sulphur would be helpful.

(h) Black dot disease

Ducomet in France in 1908 reported the occurrence for the first time of a disease which he called "dartrose" caused by *Vermicularia varians.* McAlpine some two years later found it in Victoria, Australia, and

Doidge more recently in South Africa. McAlpine named it "Black dot disease", an excellent descriptive name.

In the late summer and autumn of 1921 I discovered what appears to be the same disease at Macdonald College in Quebec. This is the first time its appearance is noted on this continent and a full description will be given later elsewhere.

Symptoms

The first symptom is a slight yellowing of the foliage which begins at the tips of leaflets and gradually involves the whole leaves. It may or may not be accompanied by dwarfing of the plant depending upon the earliness and severity of the infection. The yellowing will show early in the season on plants heavily infected but usually it is a midsummer symptom. The yellowing is followed by browning and withering of the leaves and if moist conditions prevail minute black sclerotia will develop on the surface. At this time the lower stem parts are covered with sclerotia and gradually the stem darkens and becomes brittle. On opening the stem the pith is seen to be disorganized and sclerotia line the inside walls of the vascular cylinder. Figure 13 indicates the size and number of the sclerotia both on the inside and outside of the stem. Roots and rhizomes are attacked and the tubers are covered with the minute sclerotia. It apparently does not cause serious damage to the tuber since the mycelium is confined to the superficial tissues and the sclerotia are developed on the surface or are slightly erumpent.

Mycelium is to be found throughout the stem and leaf tissues of yellowed plants which have sclerotia on the leaves.

The organism

Ducomet describes the sclerotia as astomic pycnidia 75—150 microns in diameter with setae 100 to 130 microns long and at least biseptate. The spores are slightly curved and 18-22 microns by 2.5 to 3 microns. In my cultures the spores are slightly smaller and the setae longer and no pycnidia have been found. McAlpine also states that he has found no pycnidia in Australia. More detailed discussion will appear elsewhere.

Figure 14 illustrates the development of sclerotia in a Petri dish culture on dextrose agar.

Other Hosts

Ducomet states that this organism is parasitic on Tomato and *Physalis peruviana.* I have artificially infected tomato but have not yet tried *Physalis sp.*

Control

This disease is serious only in that it weakens plants and therefore reduces the crop. Exactly to what extent it is of economic importance it is as yet impossible to state.

McAlpine advocates burning the haulms of diseased plants and selecting clean tubers for planting.

L. S. KLINCK

President of the University of British Columbia and retiring President of the Canadian Society of Technical Agriculturists, who will deliver the Presidential Address at the forthcoming Convention of the Society at Macdonald .... College, on the evening of June 26th. ....

A Course to Train Specialists in Agronomy*

By D. W. ROBERTSON,
Colorado Agricultural College, Agronomy Dept. Fort Collins, Colorado

In the last few years there has been a movement to standardize work in the colleges of the United States and Canada. Up to the present, much work has been done along this line and many suggestions have been offered.

In presenting this subject, I will endeavor to present the outline of a course suitable for specialists in the various branches of Agronomy.

In order to do this subject justice, one should be familiar with the limitations of farming in the different sections of the United States and Canada. Climatic limitations of crops should be considered and the continent would have to be divided into areas of climatic limitation, and emphasis laid on the type of farming suitable to these areas by colleges situated in them. In general, Canada could be divided into two areas where a general type of farming can be followed:(1) The prairie region, where large tracts of land are farmed by one man and where dry farming methods may be used; and (2) Eastern Canada and the Pacific Coast, where moisture is plentiful in most places and smaller areas are farmed intensively.

The aim of Agronomy courses for such an area should be to give a fundamental training in the junior years. This would enable the student to specialize at any institution in his final year, provided he had gained his required credits up to that time. He would thus be able to fit himself for whatever type of farming or research he hoped to follow.

Before entering upon the outline of a course to train specialists in Agronomy, I should like to justify such a course. Specialized training is becoming more in demand in all phases of work. The early naturalists — Darwin, Agassiz, and many others—knew all that was to be known in their day. They were geologists, zoologists and botanists. Today in the field of botany we have specialists in several lines—plant physiologists, cytologists, taxonomists, pathologists, ecologists, etc. In agriculture we have similar specialization. The early agriculturists were botanists, cerealists, agrostologists, animal husbandrymen, etc. Today we have agronomists who still deal with several phases of crop production. However, in soils which is included in Agronomy, we have many specialists — chemists, bacteriologists, soil surveyors and physicists. Many other branches of Agronomy could be broken up into specialized fields, but I will not take time to outline them. In extension work, in which a worker at one time had to be a Jack of all trades, we are now finding specialists who aid the agricultural agents in organizing their work. In many colleges you will find extension specialists in practically all the different lines of agriculture.

Requirements.

The first difficulty is to decide what are the requirements for a degree student in agriculture. We will all agree that the entrance requirement should be equal to those required for the B. A. degree. As to the practical requirements, I think one year on a farm should be required before graduation. In looking over the calendar of the College of Agriculture of the University of Saskatchewan, I find that a student is required to have one year on the farm from seeding to harvest, which would fulfil the requirement for an Agronomy student. In Colorado similar experience is required.

Experimental Training

This is an important matter to consider in some institutions. Where the term is too short to allow the student to do some practical experimental work, a summer session should be required before graduation. This would allow the student to become familiar with experimental methods.

Courses in Agronomy.

In outlining such courses an attempt has been made to give a brief description which will allow the construction of courses suitable to different conditions, but which will include all the fundamental points. In order to do this, I have first divided Agronomy into three main groups —Crops, Soils and Plant Breeding.

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* Paper read before the Western Canadian Society of Agronomy, Winnipeg, December, 1921.

OUTLINE OF SUBJECTS UNDER THE SPECIAL GROUP HEADINGS

CROPS GROUP

1. **Cereal Crops.**

A study of the more common crops, their adaptation, use and methods of culture. An elementary course.

2. **Forage Crops.**

A study of the important grass and forage crops, their adaptation, use and method of culture.

3. **Advanced Crops.**

A more detailed study of the various agricultural crops, their classification, identification, etc.

4. **Miscellaneous Crops.**

Common crops grown in other parts of the world, but not considered of enough importance to be included in 1 and 2.

5. **Milling and Baking Tests.**

An advanced course in milling and baking of special value to the plant breeder. Common tests used in flour laboratory and a study of by-products of farm products.

6. **Grain Judging and Market Grades of Grain.**

A course in which students may become familiar with the market requirements and laws and the judging of grain and soil products by methods used at the agricultural fairs.

7. **Experimental Technique and Management.**

Methods used in experimental work by the different experimental stations.

Seminars.

Special problems.

SOILS GROUP.

1. **Soils.**

Origin, physics and chemistry of soils in their relation to agriculture.

2. **Meteorology and Climatology.**

Atmospheric conditions influencing crop production, rainfall, humidity, temperature, etc.

3. **Soil Biology.**

A study of the soil bacteria, protozoa, algae and fungi in their relation to crop production and management.

4. **Soils Laboratory.**

Physical and mechanical properties of soilsin their relation to tillage, soil moisture, water application and crop growth.

5. **Soil Management.**

Influence of fertility, rotation, and different systems of farming on the fertility of the soil.

6. **Soil Investigation.**

Systems of soil investigation, sources of error and method of control.

7. **Soil Analysis.**

Physical and chemical analysis of soils.

8. **Soil Survey.**

Methods and classification of soils used by the U. S. Department of Agriculture.

PLANT BREEDING

Plant Breeding.

An introductory course dealing with the fundamental principles of development, the laws of heredity and the application of the laws to the improvement of living things.

Farm Crop Improvement.

The application of genetic principles to the improvement of crops.

Plant Breeding Seminar.

Special problems.

THE NUMBER OF CREDIT HOURS REQUIRED FOR DEGREE WORK.

Most colleges require about 130 to 150 hours and such a requirement is considered in outlining the following courses.

DISTRIBUTION OF CREDIT HOURS

	Crops Group	Credits
1.	Cereal Crops	3
2.	Forage Crops	3
3.	Advanced Crops	3
4.	Miscellaneous Crops	1
5.	Milling & Baking Tests	2
6.	Judging & Market Grades	2
7.	Experimental Technique	2
8.	Irrigation Farming	3
9.	Seminar	1

	Soils Group	Credits
1.	Soils	3
2.	Meteorology & Climatology	2
3.	Biology	3
4.	Soils Laboratory	3
5.	Soil Management	3
6.	Soil Investigation	1
7.	Soil Analysis	3
8.	Soil Survey	2
9.	Seminar	1
	Plant Breeding.	
1.	Plant Breeding	3
2.	Crop Improvement	4
3.	Seminar	1

The general distribution and prerequisites of study are very important. In distributing the courses of study over a college course, several matters should be considered. Assuming that certain general requirements are necessary for any student graduating in Agriculture, the arrangement of basic science and their major and minor course, should be considered. Many colleges require General Botany and General Chemistry as prerequisites for an Agronomy course and I think rightly so. However, this has one drawback, that of not interesting the student in some special line and giving him a chance to pick his major subject. For this reason some educators advise giving a crops and soil course in the freshman year.

PREREQUISITES FOR AGRONOMY SUBJECTS

CROPS GROUP

Cereal Crops
- General Botany

Forage Crops
- Cereal Crops

Advanced Crops
- Forage Crops
- Plant Pathology
- Botany (Taxonomy)

Miscellaneous Crops
- Advanced Crops.

Milling & Baking Tests
- Organic Chemistry
- Inorganic Chemistry
- Qualitative Analysis
- Quantitative Analysis

Judging and Market Grades
- Forage Crops

Experimental Technique & Management
- Advanced Crops
- Soils
- Geometry & Trigonometry

PLANT BREEDING GROUP

Plant Breeding
- General Botany
- Cereal Crops
- Plant Pathology

Farm Crop Improvement
- Cytology
- Plant Physiology
- Plant Breeding
- Geometry & Trigonometry

Seminars
- Course allied to problem

SOILS GROUP

Soils
- Chemistry
- Physics
- Plant Physiology

Meteorology & Climatology
- Physics

Soil Biology
- Plant Pathology
- Soils
- Bacteriology

Soils Laboratory
- Soils

Soil Management
- Farm Management
- Forage Crops
- Soils

Soil Investigation
- Colloidal Chemistry
- Soil Biology
- Forage Crops

Soil Analysis
- Physics
- Soils
- Inorganic Chemistry
- Organic Chemistry
- Quantitative Analysis
- Qualitative Analysis

Soil Survey
- Geology
- Soil Analysis

DISTRIBUTION OF STUDIES

4 Years Course ... ...

CROPS GROUP

Second year

Cereal Crops	3
Soils	3
Meteorology and Climatology	2
	8

Third year

Forage Crops	3
Judging & Market Grades	2
Soil Management	3
Plant Breeding	3
	11

Fourth year

Advanced Crops	3
Miscellaneous Crops	1
Milling & Baking	2
Exp. Technique	2
Irrigation Farming	3
Drainage	2
	13
Seminar	1
	33

SOILS GROUP

Second year

Cereal Crops	3
Soils	3
Meteorology and Climatology	2
	8

Third year

Forage Crops	3
Soils Laboratory	3
Soil Management	3
Pant Breeding	3
	12

Fourth year

Soil Biology	3
Soil Analysis	3
Exp. Technique	2
Soil Survey	2
Soil Investigation	1
	11
	31

PLANT BREEDING GROUP

Second year

Cereal Crops	3
Soils	3
Meteorology and Climatology	2
	8

Third year

Forage Crops	3
Soil Management	3
Plant Breeding	3
	9

Fourth year

Milling & Baking Tests	2
Irrigation Farming	3
Crop Improvement	4
Advanced Crops	3
Miscellaneous Crops	1
	13
Seminar	1
	31

Discussion.

In summing up, there are several points I wish to bring out. In looking over the distribution of studies, you will see that any one of the three groups would fit a student as a teacher in Agronomy. And with some extra training he could specialize in any other group if required. Another point I wish to bring out is that a specialist in any one of the groups has sufficient foundation for advanced work in that group. I should also like to emphasize the fact that a student should take special work in one of the sciences in preparing himself for this work. For instance, students specializing in crops and breeding would take more botany than is required and in soils more chemistry than is required. If intending to pursue graduate study, more mathematics should be taken.

A. H. MacLENNAN

Recently appointed Professor of Horticulture .... at the Ontario Agricultural College. ....

Micro-organisms in Creamery Butter

BY T. H. LUND

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Following a preliminary study of the yeast and mold content of twenty-two boxes of creamery butter in the Fall of 1918, a more detailed study of the microbial content of creamery butter has been carried on in our laboratories, as time and opportunity have permitted.

Our attention was first directed to this subject by several Ontario creameries shipping samples of their freshly-made butter, weekly, to the laboratory of the American Association of Creamery Butter Manufacturers in Chicago, to be analyzed for yeasts and molds. Such analytical work was carried on by the above Association for its members under the direction of Dr. G. L. McKay and Professor Bouska, and it was felt that a similar service might with advantage be made available, under the direction of the Ontario Department of Agriculture, for Ontario creameries desirous of availing themselves of it. As little detailed information was available as to the methods and applications of this particular test, it was necessary for us to try it out and see what we could make of it, before recommending it for routine use.

Two other points we had in mind in taking up this investigation, namely, to study the possibilities of the yeast and mold count as a test, in butter grading work, for distinguishing pasteurized from unpasteurized cream butter, and also as a means for determining the germicidal efficiency of pasteurization in creameries where pasteurizers were in use. A third point on which this work eventually appeared to throw considerable light was upon "creamery sanitation" particularly as it relates to cleanliness of apparatus with which the cream comes in contact after pasteurization, such as conductor pipes, coolers, pumps, churns, etc.

The need for a test to distinguish pasteurized from unpasteurized cream butter became necessary with the introduction of Government grading and the issuance of grade certificates for butter made from "properly" or "effectively" pasteurized cream. No scientific definition being available in the case of cream pasteurization to define or describe just what is meant by the above indefinite terms, it has been left largely to those in charge of the grading work to set up standards and tests, which, in their opinion, formed as a result of much practical experience, would prove most satisfactory in the long run to everybody concerned. This has resulted in the adoption throughout Western Canada and later in Ontario of the "Storch Test" and the use of pasteurizing temperatures and periods of holding sufficient to ensure a "negative" reaction when a test of

TABLE I.

Mold and Yeast Counts of Unpasteurized Cream Butter.
Creamery D, Ontario, 1919.

Date Made	Oidium Cols. per c.c.	Yeast Cols. per c.c.	Penicillium Cols. per c.c.
5— 9	25	2,000	300
5—13	750	14,000	600
5—22	330	6,000	400
6— 2	5,000	15,000	3,000
6— 6	2,000	32,000	1,000
6—14	1,200	25,000	500
7— 7	16,000	55,000	0
7— 8	10,000	60,000	0
7—17	600	25,000	80
7—28	8,500	25,000	10
8— 4	2,000	170,000	50
8—10	800	110,000	10
10— 6	1,200	34,000	4,000

TABLE II.

Distribution of Molds (oidium lactis) and Yeasts in 337 lots of creamery butter, all Storch Test negative, season 1920.

Molds counts per c.c. of butter.	93 Dominion Contest lots June, July, Sept. and Oct. entries No. of samples	Per cent.	244 Ontario lots. June, July and August No. of samples	per cent
0	30	32.3	79	32.4
1— 4	19	20.4	68	27.8
5— 9	10	10.7	24	9.8
10— 19	9	9.7	19	7.8
20— 99	11	11.8	18	7.4
100—499	10	10.7	19	7.8
500—999	0	0	7	2.9
1,000—and over	4	4.3	10	4.1
Yeast counts per c.c. of butter				
0— 99	6	6.4	16	6.5
100— 499	5	5.3	37	15.2
500— 999	5	5.3	46	18.8
1,000— 4,999	14	15.0	88	36.1
5,000—99,999	39	41.9	42	17.2
100,000—and over	24	25.8	15	6.1

the butter is made. Whether the "Storch Test" is sufficient in itself to give what information is required, or whether it needs to be supplemented by a biological test such as the "Yeast and Mold Count" is a question which presents itself for consideration when one learns the microbial content of much of the "Storch Test" negative butter being made at the present time.

With regard to the efficiency of pasteurization, by which we mean the bacteriological thoroughness with which the work is done, experience with milk pasteurizing plants all over the country has indicated that the efficiency of the process is frequently quite low. There was no reason to believe that a similar state of affairs did not exist among creameries pasteurizing their cream, particularly in some cases where the details of the work were none too carefully attended to, and where the cream at times arrived at the plant late in the day and there was more or less of a rush to get through. Then again it has been repeatedly demonstrated with regard to conductor pipes, milk and cream pumps, coolers, milk-bottling apparatus, milk utensils, churns, etc., that what is clean to the eye is not necessarily bacteriologically clean, that is to say sterile, by which we mean completely free from all living microorganisms-bacteria, yeasts and molds. Extensive contamination from unsterilized apparatus has frequently been noted in milk-pasteurizing plants, reducing thereby, very materially in some cases, the final efficiency of the process from a bacteriological point of view. There was no reason to believe that extensive recontaminations were not also commonly occurring in many creameries where pasteurization was practised, thereby nullifying to a greater or less extent, the germicidal effect of the heating process to which the cream had been subjected. To determine the extent of this recontamination and its effect on the butter, if any, has been one of the objects of this investigation, as mentioned above.

Method of Taking Samples and of Making Cultures

Samples for yeast and mold counts have been taken at the Grading Station, or at the cold storage warehouse where the scoring has been done, from the boxes of freshly made butter with scalded cheese triers, two four-inch plugs being drawn from the box and the lower three inches of each transferred to a sterile 60 c.c. glass preparation jar by means of the handle of a scalded teaspoon, and top screwed on. In a few cases where bacterial counts also were being made, sterilized triers and teaspoons have been used.

When sampling is done in the above manner it will be seen that surface contaminating organisms (molds particularly) are avoided, the examination being made on butter taken from the interior of the package, the microbial content of which may be very different from that of butter taken from the surface layer, the latter at times being very heavily contaminated with molds, while the butter in the interior of the package may be entirely free from them.

After the samples are secured they are refrigerated and shipped to the laboratory (once a week in case of the Grading Station samples) where cultures of them are made on the day of receipt or the following day.

For culture medium a wort agar of the following composition was worked out and adopted after considerable experimentation:

Wort	400 c.c.
Tap water	600 c.c.
Agar	15 grams

This has been acidified by the addition of 4 c.c. of sterile 5 per cent. lactic acid per 100 c.c. of medium immediately before plating, to inhibit bacterial growth. Colonies have been picked off these acidified wort agar plates from time to time and examined microscopically, but in no case have any bacterial colonies been found.

TABLE III.

Oidium and Yeast Counts of Butter, Domini on Scoring Contest, 1920.

93 non-reactors with Storch Test, June, J uly, Sept. and Oct. entries.

ONT.		ALTA.		N. S.		N. B.	
50.	*	4,500	*	0.	4,000	0.	10,000
6.	11,000	0	1,120	1.	4,800	0	19,000
———	———	4,700	*	24	12,000	3	*
0.	25,000	———	———	———	———	14	4,600
36	10,500	17	40,000	9	48,000	———	———
290	1,300	22	12,000	0	5,400	2	90,000
———	———	110	22,000	0	2,300	0	96,000
0	84,000	37	8,300	———	———	1	*
0	12,000	———	———	5	10,500		
1	450	5	23,000	0	220		
———	———	17	180	0	350		
0	32,000	120	5				
1	20,000	35	560				
9	*						

SASK.		MAN.		QUE.		B. C.	
2	*	1	80,000	0	960	0	3,000
48	*	0	60,000	2	2,000	0	3,400
160	*	6	100,000	100	*	———	———
12	*	200	*	12	5,500	2	*
———	———	———	———	———	———	200	*
0	30,000	340	96,000	1	13,000	———	———
3	25.000	0	1.200	0	*	0	80
6	90,000	7	700	0	36,000	0	5
10	*	1	37,000	———	———	P. E. I.	
———	———	———	———	3	55	10	*
1	90.000	16	11.000	38	2.600	5	*
25	14.500	2.100	40.000	30	1.120	0	*
———	———	6	50.000	———	———	———	———
180	*	———	———	0	800	0	15.000
30	*	1	3	0	1.100	1	22.000
110	64.000	1	4.800	0	300	———	———
		2	3	0	510	0	100.000
		6.500	Obscured			17	34.000

NOTE: Numbers above are counts per c.c. of butter.

First column—Oidium lactis mold. Second column—Yeasts.

* Over 100,000 per c.c.

TABLE IV.

Oidium and Yeast Counts of Butter. 8 *Ontario Creameries,* 1920.
76 non-reactors with the Storch Test. June, July and Aug.

A		B		C		D	
0	160	14	3,600	0	3,700	0	4,300
1	2	1	160	3	500	10	6,600
0	32	10	80	1	850	6	2,500
5	6	2	110	1	610	5	3,300
4	1,100	0	80	2	600	5	3,200
4	300	16	80	1	280	0	14,000
0	250	100	120	1	470	0	16,000
1	900	170	1,200	1	200	0	5,000
		3	160	1	240	0	4,000

E		F		G		O. A. C.	
3	310	200	1,900	600	*	22	9,500
3	3,000	75	550	2,300	*	15	7,600
3,000	*	240	6,500	600	*	29	3,100
250	6,800	24	3,000	4,000	*	7	1,450
61	1,000	14	900	600	*	5	1,480
6,500	*	0	2,100	20,000	Obscured	4	400
63	600	26	1,750	1,700	100,000	13	140
25	800	5	3,000	3,000	*	0	20
120	300			0	4,000	4	5
10	280			6	180	3	3
12	650					0	4
						1	5

NOTE: Numbers above are counts per c.c. of butter.
First column—Oidium lactis mold. Second column—Yeasts.
* Over 100,000 per c.c.

This medium has been found to be a considerable improvement on whey agar acidified with tartaric acid, such as has been used in many laboratories for similar work heretofore and has given excellent satisfaction during the three years we have now had it in use.

Of the raw cream butter 1-10 c.c., 1-100 c.c., and 1-1,000 c.c. portions have been plated, and of the pasteurized cream butter 1 c.c. 1-10 c.c., and 1-100 c.c. portions. Dilutions were made by measuring, with warmed pipettes, 10 c.c. portions of butter (melted at 110° F. and well mixed) into 90 c.c. sterile water blanks warmed up to 110° F. After thorough shaking 10 c.c. of this dilution was pipetted into another 90 c.c. blank, the mixture being shaken and the process repeated as often as required. Plates have been incubated at 25° C., Oidium counts being made after three days and yeast and Penicillium counts after five days.

Mold colonies found on cultures made from pasteurized cream butter are usually Oidium lactis only, other types of molds, Penicillium particularly, however, appear from time to time.

Counts made during 1919 showed that large numbers of yeasts and molds (Oidium and Penicillium) were present in butter made from unpasteurized cream. This is what we would naturally expect, as no steps have been taken to destroy these organisms which we know are present in large numbers in gathered cream. Counts given in Table I are typical of many others obtained of butter made from unpasteurized cream.

During 1920 our attention was concentrated on pasteurized cream butter, no counts of raw cream butter being knowingly made. Table II shows the distribution of molds (Oidium lactis) and yeasts, as found by us during 1920, in 337 freshly made lots of pasteurized cream butter, all non-reactors with the Storch Test.

The 93 Dominion contest lots came from 30 different creameries, scattered all over Canada, two, three or four in each of the nine different Provinces. The 244 Ontario

lots came from 40 different Ontario creameries.

Table III shows the distribution by Provinces and by creameries of molds and yeasts in the 93 Dominion Contest lots, while Table IV shows the distribution of molds and yeasts in 76 lots from seven representative Ontario creameries and the College creamery at the O. A. C., Guelph.

Turning to Table II we note that the number of Oidium colonies found are, on the whole, fairly low, 63.4 per cent. of the Dominion lots and 70 per cent. of the Ontario lots giving counts of less than 10 colonies per c.c. Oidium counts of over 10 per c.c. show incomplete pasteurization, recontamination of the pasteurized cream with raw cream, or recontamination from dirty pumps, conductor pipes or churns.

Yeast counts, it will be noted, run considerably higher than the mold counts, 82.7 per cent. of the Dominion lots and 59.4 per cent of the Ontario lots giving counts of 1,000 per c.c. or over.

The first assumption might naturally be that the pasteurizing temperature has not been sufficiently high to destroy these organisms in the cream. This assumption, however, is not justified; because many of the creameries showing high yeast counts are heating their cream to 180° F. and holding it at that temperature for 10 to 20 minutes. Neither will yeasts survive temperatures which give a negative reaction when Storch tests of the butter are made.

Pockets of unheated or insufficiently heated cream in pasteurizing apparatus occasionally allow yeasts to survive, as will a drop in temperature with a continuous pasteurizer, or insufficient heating of cream at the beginning or end of a run.

Occasionally raw cream finds its way into pasteurized cream, intentionally or accidentally, possibly through a leaky valve. Conductor pipes and pumps through which the pasteurized cream passes are not always as clean as they should be. Cases have been brought to our attention where the same pump and pipes have been used indiscriminately for handling both raw and pasteurized cream without any washing in between.

Any or all of these conditions will tend to increase the yeast content of the butter to some extent, but in creameries where high yeast counts are the regular thing, our investigations indicate that nine times out of ten the trouble is due to a yeast-infected churn.

The churn is the most insanitary piece of apparatus found remaining in the modern creamery. It is full of crevices and corners, shelves, rollers, eye-glasses, bolt heads, stuffing boxes, gates and doors, making it a difficult piece of apparatus to keep mechan-

TABLE V.

Distribution of Molds (oidium lactis) and Yeasts in 537 lots of Ontario creamery butter, all Storch Test negative, season 1921.

Oidium Counts per c.c. of butter	Number of Samples	Per cent
— 0	128	23.8
1— 4	152	28.3
5— 9	54	10.1
10— 19	58	10.8
20— 99	77	14.4
100—499	49	9.1
500—999	6	1.1
1,000—and over	13	2.4

Yeast Counts per c.c. of Butter	Number of Samples	Per cent
0— 99	54	10.1
100— 499	95	17.7
500— 999	50	9.3
1,000— 4,999	152	28.3
5,000—99,000	132	24.5
100,000—and over	54	10.1

TABLE VI.

Showing correlation of Yeast and Bacterial content of 43 samples of Ontario Creamery butter, season 1921.

Number of Samples	Yeast Content per c.c.	Average Bacterial Content per c.c.
6	10— 80	36,583
10	110— 880	96,750
15	1,100— 5,000	791,300
6	12,700—80,000	2,712,000
6	100,000—and over	6,897,000

ically clean. Being made of wood it is porous and, therefore, difficult to keep bacteriologically clean. Yeasts and other organisms get down into these pores and survive destruction when the churn is washed and scalded in the usual way. Even a thorough washing with chloride of lime solution is not effective, according to our experience, in eliminating yeasts from a yeast-infected churn. Stuffing boxes, where the pins of the worker rollers pass through the head of the churn, are frequently hotbeds of infection as may be readily shown by making a culture of the salve-like material which oozes out from them.

During the time which elapses between the washing and draining of a churn on one day and of its use a day or two later, conditions are frequently ideal in the pores of the wood for an abundant growth of yeasts. The acid reaction which becomes established in the wood due to frequent contact with sour cream is particularly favorable. Sufficient food supply and moisture remain, while air is available at the surface of the pores, and an ideal temperature for growth usually obtains. The hurried so-called "scalding" which a churn receives just previous to running in the cream does not eliminate the yeasts which have accumulated over night, and after a few revolutions in such a churn we find that our pasteurized yeast-free cream contains numerous yeasts.

The following facts have also been noted:

1. Butter made from properly pasteurized cream in a new churn is usually low in yeast content.

2. Where two or more churnings a day are made in the same churn, butter from the first churning will almost invariably contain the largest number of yeasts.

3. If a churn stands idle for several days the yeast content of butter made in it when brought into use again will usually be high.

4. Repacking of the boxes where the worker roller pins pass through the head of the churn frequently results in a reduction of the yeast content of the butter, sometimes to a very marked degree.

The following method for treating yeast-infected churns has been used by us effectively (see Table IV, O.A.C. Creamery), and has resulted in the reduction of the yeasts in the butter to less than 10 per c.c.:

Rinse out the churn after use with hot water and give a thorough washing with a hot solution of alkali washing powder to remove grease and to neutralize the acid which has soaked into the wood while churning the sour cream. Secure a few lumps of fresh unslaked lime and slake by adding small quantities of hot water from time to time. When slaked add sufficient hot water to make up to ten gallons or so. Mix well and pour into churn. Turn steam hose into this milk of lime mixture and bring to the boil. Close churn doors and revolve for fifteen minutes, five minutes at high speed, and ten minutes at low speed with worker-rollers in gear. Stop churn, turn in steam hose and bring milk of lime mixture to the boil again. Revolve fifteen minutes more as above. Do not dump out lime mixture but turn churn doors to top and fill to the brim with cold water. Allow churn to stand full of this lime water until required for use again. Empty out lime water, wash out thoroughly with two changes of cold water, and the churn will be found to be practically yeast-free. Where churns are in daily use the above treatment should be applied once a week, preferably over the week-end. Where churns are to stand idle for some time they should be treated as above and left filled to the brim with the diluted milk of lime. The stuffing boxes around the worker-roller pins should be repacked from time to time, or, as has already been mentioned, serious

TABLE VII.

Oidium, Yeast, and Bacterial Counts, and Storch Tests, June entries, Dominion Scoring Contest, 1921.

Prov.	Oidium Cols.	Yeast Cols.	Bact. Cols.	Storch Test
Man.	0	680	54,000	N. R.
Que.	0	4,900	23,000	N. R.
N. B.	1	15,000	590,000	L. R.
N. S.	0	84,000	180,000	N. R.
Ont.	8	100,000	1,900,000	N. R.
Alta.	70	195,000	2,100,000	N. R.
P. E. I.	1	330,000	2,000,000	L. R.
B. C.	390	360,000	3,000,000	N. R.
Sask.	470	890,000	10,000,000	N. R.

N.R. = No reaction. L. R. = Light reaction.

yeast and oidium contamination will occur from these.

Counts given in Table III show that yeast and mold infection of butter made from pasteurized cream is fairly general throughout the Dominion, with marked variations, however, between different creameries, and also between different churnings made at the same creamery on different days. Counts given in Table IV show that butter made in some creameries is consistently low in yeast and mold content, while that made in other creameries is consistently high; it also shows what was accomplished in the way of reducing the yeast and mold content of butter manufactured at the O.A.C. creamery, by the application of intelligent care.

It has been suggested that possibly some of the yeast infections referred to above have been caused by the addition of yeasty starters to the pasteurized cream or by working butter in same. I do not believe this factor enters the present case to any extent, because creameries using starters are quite the exception in Canada at the present time. Not a single one of the 30 creameries represented by the 93 Dominion Contest lots, counts of which are given in Table III, used starter in any shape or form.

Interest by Ontario creamery men in the

TABLE VIII.

Examples of Mold and Yeast Counts, four Ontario creameries, season 1921.

Creamery A. Poor.		Creamery B. Variable		Creamery C. Improving		Creamery D. Good	
6	8,000	10	*	300	98,500	7	16
20	18,000	1,300	37,000	1,000	*	9	10
60	90,000	300	*	1,200	*	0	6,100
3	7,000	4	3,800	1,400	*	4	80
30	6,500	600	13,300	32,000	*	5	20
100	*	10	3,700	0	4,500	3	1,200
150	*	0	130	2,500	80,000	0	270
2,000	*	2	2,600	145	10,366	0	70
600	6,300	2	3,700	13	1,500	0	600
1,300	13,000	1	1,400	1	330	20	50
210	32,000	10	60,000			6	80
160	4,400	0	5,000			2	10
100	20,400	0	*			1	60
40	*	170	9,700			0	5
20	*	1	*			0	120

Figures indicate colony counts per c.c. of butter. First column oidium lactis mold, second column yeasts.

*=over 100,000.

microbial content of creamery butter, particularly that made from pasteurized cream, developed to such an extent in 1921 that it was found necessary to employ a man to devote his whole time to this work during the five summer months, May to September inclusive, this being the season when the bulk of the butter grading in Ontario is done. Mr. D. B. Shutt, a third year O.A.C. student, was engaged for this work and counts of Ontario samples reported in Tables V, VI and VIII were made by him.

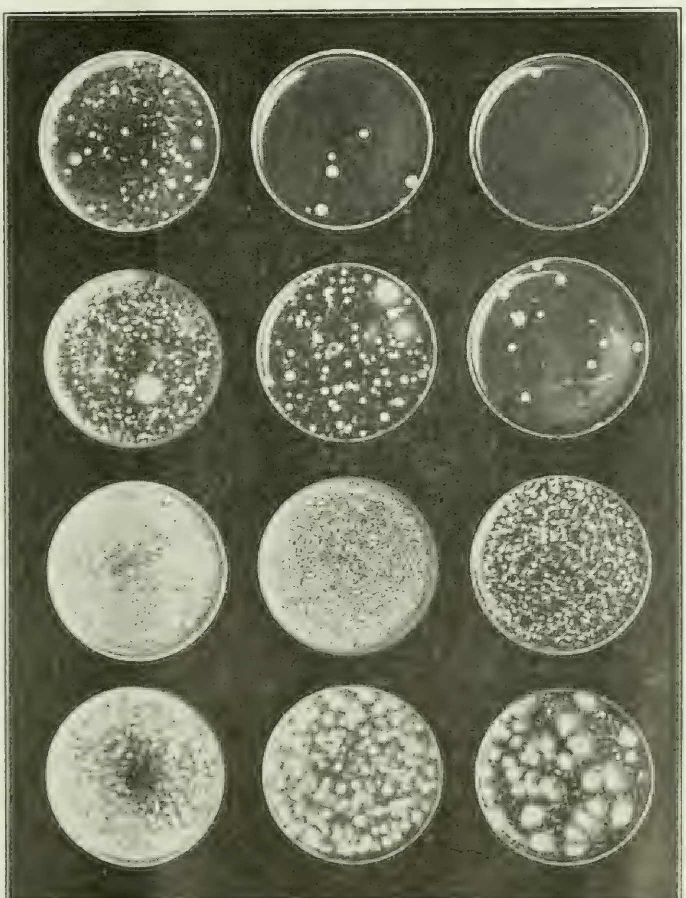
Five hundred and seventy-four samples of butter were received from the Grading Station during the summer of 1921, compared with 315 during 1920. These 574 samples represented butter made in 56 creameries, 513 of them coming from 43 creameries, an average of 12 samples per creamery or one every 10 days. A summary of the mold (oidium lactis) and yeast content of 537 Storch test negative lots as determined by us during 1921 will be found in Table V.

Compared with the counts of Ontario samples, (season 1920), given in Table II, no marked improvement for 1921 can be noted. This is explained by the fact that a number of new creameries were sending samples during 1921 that had not sent samples previously, and these counts usually ran high. Creameries which sent us samples during the two years have usually shown a marked lowering of their counts during 1921.

A number of bacterial counts were also made to determine if there were any correlation between the yeast and the bacterial con-

Cultures of Butter. Dominion Scoring Contest, September, 1920.

1 c. c. 1/10 c. c. 1/100 c. c.



Entry No.	Oidium Colonies per c. c.	Yeast Colonies per c. c.
74.	0.	220.
72.	1.	4,,800
21.	160.	Over 100,000
11.	4,700	Over 100,000

tent of pasteurized cream butter. The figures given in Table VI plainly show that a distinct correlation between these two groups of micro-organisms does occur. That is to say that butter of low yeast content will usually be low in bacterial content when no starter has been used, and butter of high yeast content will in all probability be high in bacterial content too. A similar, but possibly more marked correlation was found in 18 Dominion contest lots (May and June entries, 1921), the counts obtained in the nine June entries being given in Table VII.

In Table VIII will be found examples of mold and yeast counts from four Ontario creameries, made during 1921, showing results which may be classed as poor, variable, improving and good. Creameries such as A, B and C may well ask themselves whether everything in their plants is O.K. Creamery C realized the need for action and got busy, the result of their clean-up being plainly visible in its effect on the yeast and mold content of their butter in a comparatively short time; Creamery D tied with another creamery for the lowest series of counts obtained during 1921.

The significance of such large numbers of living micro-organisms in Storch Test negative butter, such as their relation to general creamery sanitation, to efficiency of pasteurization, to recontaminations, and particularly to butter flavor and keeping quality, are matters of interest to creamery men, butter graders and butter exporters as well as to dairy scientists whose business it is to find out the cause and effect of phenomena such as these.

While a good understanding has been obtained of the first three of the above-named relations, we have been unable up to the present time to establish any definite and consistent relation between numbers of micro-organisms in butter and flavor and keeping quality, although considerable data have been secured along this line. Several theories may be advanced to explain why no such relation has yet been found. We admit that we have only scratched the surface of this problem as yet, as the time at our disposal has not permitted a thorough and detailed study of all the factors involved.

Dr. G. L. McKay of the American Association of Creamery Butter Manufacturers, one of the foremost butter experts on the continent, in discussing this matter at the annual convention of the Canadian Creamerymen's Association of Ontario, held in Toronto December last, stated as follows:

"We analyze thousands of samples of butter, both chemically and bacteriologically. Some of our best creameries keep their mold and yeast count down to ten and below per cubic centimeter of melted butter, while we have dozens of others that the number of molds and yeasts present in their butter renders it countless. It has been found in investigational work done by one of my assistants that the butter containing a high per cent. of molds and yeasts does not usually possess good keeping qualities.

The creameries that have a low count are the creameries that exercise extra precaution in endeavoring to sterilize everything that comes in contact with milk and cream. These are the creameries that are making good butter.

I don't personally think that the presence of molds and yeasts in butter, as far as they are concerned themselves, has a detrimental effect on the butter. I am under the impression that their presence in the butter, in almost all cases, is an indication of filth from insanitary conditions observed in the creamery. Hence, butter of that character will not keep well."

HULLED AND UNHULLED TIMOTHY SEED.

To ascertain whether any injury results from removing the hull from timothy seed, the Division of Forage Plants of the Dominion Experimental Farms planted plots, side by side, one with timothy seed that had been hulled, and the other with unhulled seed. The results obtained indicate, that, while there is no material difference in vitality between hulled and unhulled seed when sown a year after it has been harvested, the hulled seed with age loses its vitality more quickly than does the unhulled seed. That it to say, unhulled seed may be safely sown the second or even the third year after it is grown, but hulled seed should not be kept longer than one year before planting. In 1920 the hay crop from the unhulled seed of 1917 amounted to 2 tons, 840 pounds, while the crop produced from the hulled seed amounted to only one ton, 375 pounds.

La Bacille de la Tuberculose dans les Produits Laitiers

J. E. Thériault, B.A.; B.S.A.
Professeur de Bactériologie à l'Ecole de Laiterie, St-Hyacinthe, P. Q.

Des recherches nombreuses, faites surtout depuis l'année 1900, ont démontré que le bacille tuberculeux, s'il n'est pas exposé a l'action directe des rayons solaires, peut vivre très longtemps, même jusqu'à deux mois. C'est donc dire que si le Bacille se rencontre dans le beurre ou les produits laitiers, il pourra y maintenir sa vie pendant un temps assez long, puisque là, il n'aura pas à craindre les rayons ardents du soleil.

Mais est-ce que ce terrible bacille peut se trouver même dans le beurre et le fromage?

D'abord, ces produits commerciaux dérivent du lait. Or, on sait que le lait peut contenir des germes tuberculeux. Des recherches précises sont allées jusqu'à démontrer que dans certaines villes la proportion des laits infectés du germe peut aller jusqu'à 20% et même au-delà. Rien de surprenant donc que le germe passe dans le beurre et qu'il y vivre en toute sécurité, si ce beurre n'a pas été fait avec de la crème pasteurisée.

Mais il y a plus, et des analyses bactériologiques de beurre et de fromages ont démontré l'existence du Bacille dans ces produits.

1. *Le beurre.* La crème, soit qu'elle ait été séparée du lait naturellement ou par la force centrifuge dans les séparateurs, emporte avec elle une foule de germes bons et mauvais, une foule de ceux qui sont dans le lait. Si le lait est tuberculeux, et nous savons qu'il peut l'être assez souvent, les germes tuberculeux, s'accrocheront aux globules gras pour être entraînés tout comme les autres.

Une quarantaine d'examens bactériologiques ont été effectués par Briscol et MacNeal, sur des beurres de 24 villes européennes et ceux d'une ville américaine. Des 1233 échantillons de beurre examinés, 163 ont été trouvés tuberculeux, soit 13.2%. Transportant leur travail sur des beurres de la ville d'Urbano, Ill., ils ont trouvé deux échantillons de beurre tuberculeux sur les deux seuls échantillons examinés, soit 100%.

De plus, ils ont constaté que le Bacille garde sa vitalité pendant un temps assez long, même plus long que le temps de l'entreposage, confirmant en cela les expériences de Mohler sur le même sujet.

2. *Le fromage.* Le fromage subit plusieurs phases de transformations avant d'en arriver à un produit comestible et commercial. Aussi il n'est pas surprenant que la présence des germes pathogènes en particulier des germes tuberculeux soit influencée par ces modifications radiales. C'est pourquoi le temps de la maturation joue un rôle si important au point de vue du germe tuberculeux.

En Suisse, où l'on fabrique l'Emmenthal sur une grande échelle, le bacille tuberculeux est détruit alors que le produit est livré au marché; cette destruction est causée par les fermentations spéciales que l'on provoque dans la fabrication de cette sorte de fromage.

Il n'en est plus de même du fromage Cheddar, le nôtre. Le processus de la maturation n'est pas funeste à la vie du germe, et cette vitalité peut se prolonger pendant plusieurs jours et même des mois. Ce fait d'ailleurs a été démontré par Mohler et Doone après examens faits sur des fromages Cheddar dans le Marylanl, avec du lait tuberculeux. Après 122 jours de maturation, on a encore trouvé vien vivant le germe tuberculeux dans le fromage.

Après ces quesques notes, que conclure, sinon au danger qui peut résulter de l'emploi d'un lait infecté pour la fabrication des produits laitiers. Sans doute tous les beurres ou tous les fromages ne sont pas infectés, mais la proportion est encore malheureusement trop grande pour qu'on s'efforce de prendre les moyens de la diminuer. Et on fera disparaître les laits et les produits laitiers tuberculeux en employant les moyens radicaux qui sont à notre disposition: la sélection des bêtes, laitières par l'épreuve à la cuberculine et la pasteurisation du lait ou de la crème.

Nos Connaissances Actuelles sur le Lait*

Par M. Louis Bourgon,

Professeur à l'Ecole Polytechnique, Montréal.

"On a des chires mais pas de doctrine" Professeur Ch. Porcher (1)

Le lait et le sang sont les deux liquides naturels les plus délicats que nous connaissions. Malgré le grand nombre de travaux auxquels l'étude de ces substances a donné lieu, il est encore des certitudes qui nous manquent et demain peut modifier notre opinion d'aujourd'hui.

Le lait, en dehors des altérations microbiennes dont il peut être l'objet, est un composé vivant dont nous ne pouvons faire actuellement l'étude sans rompre l'ahrmonie de sa composition physique ou sans placer les éléments chimiques qu'il renferme dans un état particulier, différent de celui qu'ils revêtent dans le liquide originel que la nature nous donne. Ce point est essentiel, il appelle la prudence dans nos jugements dont il est bon de bannir l'absolu qui risquerait souvent de reposer sur un base incertaine.

Pour le physiologiste le lait est le liquide sécrété par les glandes mammaires quelques jours après la naissance du jeune et devant servir à sa nourriture. Pour le chimiste, c'est un liquide légèrement visqueux, opaque et porcelané composé d'éléments chimiques sous des aspects particuliers.

Les éléments du lait, leur provenance

L'étude chimique des constituants du lait semble arrivée à un point critique. Les méthodes dont nous disposons ne peuvent nous donner les certitudes qui nous manquent. Depuis quelques années on a dû demander à la physico-chimie et à la chimie biologique de nous éclairer afin de poursuivre les investigations. Mais, ces sciences elles-mêmes excessivement délicates, ne progressent que lentement et si les connaissances qu'elles ont fournies sur la composition du lait ne sont pas très nombreuses, il n'est pas exagéré de dire que c'est d'elles que celui qui s'occupe du lait attend des directives.

On s'est aperçu en effet qu'il était bien plus important de savoir sous quelle forme un élément se trouve dans le lait plutôt que de connaître les variations pondérables d'un jour à l'autre ou la composition élémentaire d'un corps isolé du liquide. Tous les laits sont des complexes qui renferment dans de l'eau (87 à 88%) trois sortes d'éléments: a) des éléments solubles: b) des éléments insolubles en suspension: c) des éléments en pseudo solution ou suspension colloïdale. Il convient d'ajouter, pour être complet, des substances de nature indéterminées (diastases, vitamines) qu'on trouvera peut-être sous l'un des trois états plus haut mentionnés à l'intérieur des molécules des corps chimiques connus.

Composition chimique d'un lait de vache,

(Orla Jensen)

Densité à 15° C	1033.5
Lactose % du lait	4.99
Matière grasse	4.45
Caséïne	3.13
Albumine	0.44
Autres Protéïnes	0.11
Substances aminées	0.23
Eléments inorganiques	0.65
Chaux des phosphates	1.36
Chaux de la caséïne	0.48
Magnésie	0.15
Potasse	1.69
Soude	0.59
Chlore	0.10
Acide sulfurique	0.03
Acide phosphorique des phosphates.	0.137
Acide phosphorique de la caséïne .	0.060

a) Eléments en solution.

Les éléments solubles comprennent le lactose, le phosphocaséinate de chaux, l'albumine, des sels, des gaz, des diastases. On a signalé tout dernièrement dans le lait[2] la présence de pentoses, matières hydrocarbonées voisines du glucose, mais il règne une incertitude sur le dosage de ces substances analogues aux sucres et dont l'origine serait les fourrages.

Le lactose est le seul sucre vraiment connu

* *Communication faite le 9 novembre 1921, au congrès des vétérinaires du Canada à Montréal. Extrait de la Revue Trimestrielle Canadienne.*

Ch. Porcher; *Coup d'oeil d'ensemble sur le lait: Bulletin de la Société d'Hygiène alimentaire No. 8-1920.*

2 Sur la présence des pentoses dans le lait, O. Laxa *Le lait, No 3—1921.*

du lait. C'est un composé chimique parfaitement défini, il est identique dans tous les laits provenant d'espèces différentes, c'est l'élément le plus abondant dans les laits de femme (6.5 p.c.) et de vache (4.9 p.c.) que nous considèrerons plus particulièrement. Ce sucre réducteur ne fermente pas sous l'influence de la levure de bière, il est dédoublé grâce à des levures spéciales et peut alors donner de l'alcool; des microbes par leur diastases le transforment en acide lactique, en acide acétique ou butyrique.

D'où vient le lactose du lait? Claude Bernard ayant découvert le glucose du sang émit le premier l'hypothèse que le sucre de lait provenait du sang. Des expériences précises[3] permettent de dire que c'est la cellule mammaire qui fabrique le lactose avec le glucose apporté du foie par le sang[4]. Comment s'opère cette transformation et pourquoi se fait-elle d'un sucre à un autre sucre, nous en sommes réduits à des suppositions; la formation de l'élément le plus simple du lait est inconnue!

Le phosphocaséinate de chaux, combinaison de deux corps insolubles, est en solution dans le lait où il est associé à l'albumine. On parvient à le doser par différence grâce à l'écart qui existe entre les pouvoirs rotatoires de — 116 pour le phosphocaséinate de chaux et de — 30 pour l'albumine. Ce corps étant plutôt une combinaison formée au sein du liquide que pendant la sécrétion elle-même nous ne considérons pas son origine physiologique.

Je ne puis m'étendre sur les longues discussions relatives aux matières azotées du lait, elles sont tellement importantes qu'elles mériteraient une étude spéciale. Ces constituants sont à la fois les plus instables et vraisemblablement les plus importants. Il paraît raisonnable, dans l'état actuel de nos connaissances,[5] d'admettre qu'il existe bien mais le lait une albumine qui est en solution.

Cette albumine, appelée quelquefois lactalbumine caséïne soluble de Duclaux dont la proportion serait de 0,5 p.c. dans le lait de vache, de 1 p.c. environ dans le lait de femme, qui possède un pouvoir rotatoire (moléculaire) de — 30 à — 37 est-elle dans la lait sous la forme où nous la trouvons? Il ne faut pas oublier que pour l'isoler nous devons faire subir au lait certains traitements qui ne sont pas sans ébranler l'édifice moléculaire compliqué de l'albumine.

La présence de globuline ou lactoglobuline est un peu moins nette. Toutefois, à l'aide de la méthode délicate des sérums précipitants,[6] on a pu trouver l'identité de la globuline du sérum sanguin et de la substance qu'on a désigné lactoglobuline dont l'hydrolyse fournit du glycocolle et qui possède un pouvoir rotatoire de 47,6. (Frédéricq.)

Ces substances albuminoïdes ont une origine sanguine, elles sont apportées par le sérum qui filtre à travers la couche des cellules épithéliales de la glande en contact avec le sang. La preuve de cette origine nous est fournie par le fonctionnement de la glande à l'état pathologique; la composition du lait est grandement modifiée et tend à se rapprocher de celle du sérum sanguin, la proportion d'albumine et de globuline augmente alors que le taux de caséïne diminue.

En dehors de ces substances azotées appartenant au groupe des albuminoïdes on a pu isoler dans le lait de l'urée (0,5gr par litre), de l'acide orolique (0,003gr par litre), de l'hypoxanthine, de la créatine, de l'adénine et de la guanine, avec moins de certitude un pigment jaune identifié urobiline; tous ces corps dans la proportion d'à peu près 15 miligrammes par litre. Ce sont plutôt des déchets que l'on rencontre dans l'urine comme produit d'excrétion du rein; ils permettent de donner à la mamelle l'adjectif de glande d'excrétion qu'elle ajoutera à celui de sécrétion pour lequel elle est réellement spécialisée.

L'acide citrique se rencontre dans le lait au taux d'environ 2grs par litre pour le lait de vache. Cet acide organique solubilise le phosphate de chaux. Il est important de savoir que le chauffage transforme et fait disparaître une grande proportion de cet acide entraînant alors une précipitation de phosphate. Nous ne savons absolument rien sur

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3 Paul Bert-Porcher-Kaufmann et Magne. Ch. Porcher: *De la lactosurie. Monographies cliniques, Masson* 1906.

4 A. Monvoisin: *Le lait,* 1920.

5 L. Lindet: *Le lait* 1907 — Monvoisin loc. cit. —M. Beau: *Les matières albuminoïdes du lait; Le lait* No 1 — 1921; L. Lindet: *Les matitères albuminoïdes du lait, Le lait* No 4 — 1921. Heineman: *Milk* (Philadelphie 1919).

6 Le lait de chaque espèce contiendrait des albumines donnant la Réaction de Bordet: c'est-à-dire qu'il se forme un précipité dans un lait d'une espèce déterminée quand on y ajoute quelques gouttes de sérum provenant d'un animal (lapin) auquel on a fait des injections répétées du lait de l'espèce. On peut identifier ainsi les différents laits et décéler les mélanges.

sa provenance. Enfin se trouvent en solution des sels minéraux qui ne correspondent pas exactement à ce qu'on désigne généralement sous le nom de cendres. Ces éléments chimiques sont assez nombreux mais leur quantité est toujours minime. Le fluor, le chlore, l'iode, le soufre sont caractérisés sous la forme minérale, le phosphore sous forme d'acide phosphorique, puis on rencontre de l'arsenic, du silicium, bu bore, du lithium, du potassium, du sodium, et surtout du calcium. Les corps tels que magnésium, zinc, cuivre, fer, maganése, aluminium sont à l'état de traces. Ces éléments ne sont pas à dédaigner parce que leur quantité est le plus souvent inférieure au milligramme: nous savons aujourd'hui que des traces d'une substance sont quelquefois plus nécessaire à la vie qu'une masse imposante. Le rôle de ces éléments s'il demeure obscur n'en semble pas moins positif, ils se sont pas dans le lait par accident et notre organisme auquel ce liquide est destiné est un réactif autrement sensible que les plus parfaits de nos laboratoires.

Les combinaisons les plus importantes de ces corps minéraux sont néanmoins le citrate de sodium, les phosphates bicalciques et tricalciques ainsi que les chlorures; sur une quantité totale de 8 grs au litre ces derniers (exprimés en chlorure de sodium) représenteraient 1,5 et les phosphates 4 grs.

La présence des sels minéraux dans le lait ne peut s'expliquer que par l'apport sanguin. En gros on retrouve les mêmes corps dans les cendres du lait et des globules du sang mais la proportion se trouve bien changée pour chacun des sels. Il est à remarquer qu'au total ces matières varient trèe peu, elles contribuent à donner au lait cette constance importante: le point de congélation, résultat de la concentration moléculaire sous la seule influence des substances dissoutes. (0,54 à 0,56). Le point de congélation du lait qui est pratiquement le même que celui du sang est maintenu à cette fixité relative très grande par suite de la facilité avec laquelle les substances en solution, comme les sels minéraux, particulièrement les chlorures, traversent les cellules épithéliales pour assurer entre les liquides de chaque côté des membranes cellulaires une pression osmotique semblable. L'isotonicité semble nécessaire au fonctoinnement normale de la glande mammaire, et il est curieux de remarquer que, dans les états pathologiques, la composition du lait tend à se rapprocher beaucoup de celle du sérum sanguin bien que les points de congélation soient différents.[7]

(à suivre)

LA CONVENTION DU MOIS DE JUIN

Les techniciens agricoles du pays, les porteurs du flambeau de la science agronomique au Canada, les membres de la Société des Agronomes Canadiens, au nombre de 600, tiendront, au mois de juin, dans la province de Québec, où Louis Hébert, il y a trois siècles, traçait le premier sillon, leur convention annuelle.

Cette convention sera l'événement agricole le plus important qui se soit encore vu dans la province de Québec. Les techniciens agricoles des diverses provinces de la confédération seront, en effet, les hôtes du vieux Québec.

Les réunions se tiendront au Collège Macdonald. Les sommités du monde agronomique traiteront là des sujets de la plus haute importance. Le ministre fédéral de l'agriculture, l'hon. M. Caron, etc., adresseront la parole aux délégués. Les trois universités de la province seront représentées. Le programme, La Revue le publiera plus tard, sera le plus important que la Société ait encore élaboré. Les délégués se rendront à Oka, où un grand banquet sera servi. Que tous se donnent la main — représentants de l'agriculture dans la provinceè agronomes, etc., —pour que cette convention, tenue à Québec, laisse dans le coeur des délégués un souvenir ineffaçable.

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[7] Pour 1000

	Lait normal	Tuberculeux	Sérum sanguin
Matières albuminoïdes	38,5	72,4	75,80
Matières grasses	46,5	0,7	1,3
Sucre ..(lactose)	43,5	0,2 (glucose)	1,5
Cendres	7,3	9,6	8,7
Chlorure de sodium	1,4	5,1	5,6
Point de congélation	—0,55	—0,51	—0,55

Comme autres constantes physiques du lait nous mentionnerons: le point d'ébullition 101 deg. C (213F), l'indice de refraction du petit-lait (sérum) 1.3431 à 1.3442 à 15 deg. celui de l'eau étant de 1.3330; la résistance électrique 235 à 265 ohms à 16 deg. C la viscosité par rapport à l'eau peut varier de 1.99 à 2.06.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

The Second Annual Convention

The success of the Second Annual Convention is already assured. The attendance will be larger than at the Organizing Convention in Ottawa two years ago or at the Winnipeg Convention last year. Several committees are now completing local arrangements, and those who attend will spend an enjoyable and profitable week.

A new feature is being introduced at this Convention, by providing a series of advanced lectures, by prominent men, in economics, plant industry and animal industry. In arranging these lecture courses the Society has received generous financial aid from the Federal Department of Agriculture.

The final Convention programme will not be ready for mailing until June 15th, and it is possible that unavoidable delays in printing may make it necessary to postpone general distribution until the Convention opens. The following programme will be followed with minor changes, and is given here for the benefit of those who are planning to attend the Convention:—

MONDAY, JUNE 26th.

Registration, Men's Residence.

All trains will be met by the Reception Committee. Members and guests will receive badges, programmes and a guide to the buildings, etc., when they register.

9.00 A. M. Meeting of Retiring Dominion Executive

11.00 A. M. Minutes of last Convention Appointment of Committees on Resolutions, Constitution, Nominations, etc. Appointment of Auditors.

This will be a short meeting for the transaction of routine business.

2.00 P. M. Reports of Local Branches.

These reports will be given by a representative of each of the thirteen local branches, and will be limited to six minutes each. They will indicate the progress made during the past year and, after presentation, should be submitted in writing to the General Secretary.

3.15 P.M. Reports of Standing Committees on Research, by J. M. Swaine
Marketing Education, by H. S. Arkell
Educational Policies, by J.B. Reynolds

These will be three very interesting reports. The committees on Research and

J. B. REYNOLDS
President of the Ontario Agricultural College, Guelph, Ontario, who succeeds L. S. Klinck as President of the C. S. T. A. and will preside at the Annual Convention this month.

Marketing Education presented valuable reports last year and the reports this year will indicate further progress made.

The committee on Educational Policies was appointed a year ago. It was considered desirable that full enquiries should be made as to the policies now in effect in the Dominion Department of Agriculture, the various provincial Departments and the Agricultural Colleges. The results of these enquiries will be embodied in this report, and suggestions and recommendations will be made as to the possibility of having more uniformity, and perhaps closer co-ordination of work, on the part of these various institutions.

It is expected that considerable discussion will follow the presentation of this report.

4.15 P. M. Amendments to By-laws.

Two suggested amendments to the by-laws of the Society will be introduced by the Dominion Executive, for the consideration of the Convention.

HON. MANNING W. DOHERTY
Minister of Agriculture for Ontario
Who will address the Convention on June 27th.

The first of these would give each local branch a representative on the Dominion Executive, instead of each provincial branch. At the present time this affects only the Provinces of Ontario, Quebec and Saskatchewan. In the past it has been found that Provincial Executives, when appointed, do not function, and it will perhaps be better to have direct communication between the Dominion Executive and each Local Branch Executive, even when there is more than one local branch in a province, and to give each local branch a representative on the Dominion Executive. Under present conditions this would increase the personnel of the Dominion Executive by three members.

The question of membership fee will be introduced for full discussion. There is undoubtedly a good deal of criticism of the present \$10.00 annual fee, and it has interfered with the progress of the Society. Whether it can be reduced or not depends upon the financial success of the official organ. If "Scientific Agriculture" can be made to carry part of the Society expenses, the fee can be reduced accordingly, and the magazine has perhaps not been in existence for a period sufficiently long to warrant a safe forecast being made. It may be advisable to have an entrance fee of \$5.00 and an annual fee of \$5.00. This would carry the present members for \$5.00, but would keep the initial fee for new members at \$10.00, for the first year.

8.00 P. M. Report of General Secretary-Treasurer.

This report will cover the work done during the past year. It will deal mainly with finances, the magazine, and the problems which have had to be faced and overcome in order to bring the organization through a very trying period. Certain recommendations will be made as to the operating policies which should be put into effect for the coming year.

9.00 P. M. Address of the retiring President.

After two years of service, during the entire period of organization, President Klinck is well qualified to give his impressions of the progress made and the possibilities for future development. This will be an open meeting.

TUESDAY, JUNE 27th.

9.00 A. M. The Bureau of Records.

During the past year, this Bureau has been established in the office of the General Secretary. It contains a record of the academic standing, professional experience and general qualifications of a large majority of the members. It can be made a distinct service to the members and to agencies which employ trained men. Before developments are undertaken, it is considered that further discussion of the operating policies of the Bureau is necessary.

9.45 A. M. Scientific Agriculture. Its Editorial Policy.

An understanding should be reached as to the editorial policy which should be adopted for the official organ of the Society: whether it should publish only articles which are strictly technical, whether it should contain a technical section, whether it should publish both technical and popular articles, whether special supplements devoted to research should be published, etc., etc. It has been difficult to adopt any definite policy in the past and this is the first opportunity, since the Society took over the magazine, of discussing a very important question.

10.45 A. M. Scientific Agriculture. Its Advertising Policy.

Under Society ownership, a restrictive or selective advertising policy has been adopted. The advertising pages of the magazine have published no announcement which had not been approved by qualified members and which could not be safely endorsed by the Society. The value of that policy is not yet fully appreciated by the members or by the advertisers. The benefit to the advertiser is an indirect one, but unquestionably it is an important one. Advertisements should be written for the professional workers and not solely for the farmers. The farmers, or consumers, are reached in many cases by the trained agriculturists, and these trained men need a reliable guide to reputable firms and products. That is what the advertising pages of Scientific Agriculture aim to supply, but their full value to the advertiser will not be obtained until the members appreciate the support they are receiving from the advertiser and the service which they can give.

Representatives from the manufacturers and from advertising agencies are being invited to attend this session.

12.00 noon. Group Photograph.

WEDNESDAY, JUNE 28th.

9.00 A. M. Reports of Convention Committees

9.30 A. M. Fellowships and Honorary Memberships.

On the recommendation of the Dominion Executive Committee, and with the approval of the Convention, certain members will be granted Fellowships in the Society, and certain non-members will be given honorary membership.

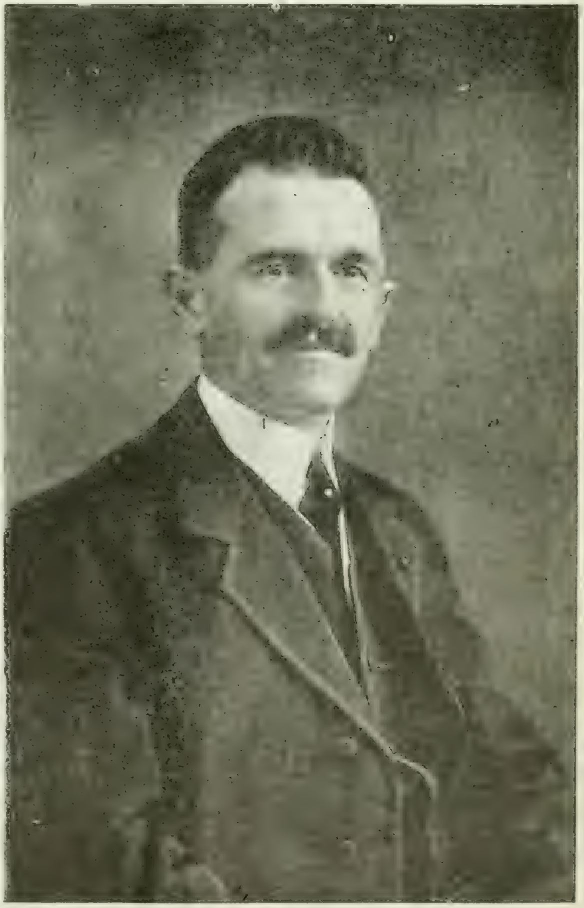
9.45 A. M. Place for 1923 Convention.

Under the present Constitution the Annual Convention is held alternately in eastern and western Canada. The 1923 Convention should therefore be held in the West.

10.00 A. M. Report of Auditors.

10.15 A. M. New Business.

An apportunity will be here provided for



HON. J. E. CARON
Minister of Agriculture for Quebec
Who will address the Convention on June 27th.

a free discussion of any matters pertaining to the welfare of the Society, any business arising out of the Convention, etc.

12.00 noon Adjournment of Business

9.00 P. M. Meeting of New Dominion Executive.

ADVANCED LECTURES

A special Committee is arranging the courses of lectures in animal industry, plant industry and economics. Speakers and subjects cannot yet be fully announced.

These lectures will be given on Tuesday and Wednesday afternoons, all day Thursday and all day Friday. No lectures will be given in the evening.

The lectures in economics will be open to all, but those in plant and animal industry will be parallel lectures and members can attend either.

Six lectures will be given in each subject: one on Tuesday afternoon, one on Wednesday afternoon, and two each on Thursday and Friday.

Professor W. T. Jackman of Toronto University will give four lectures in rural economics, as follows:-

1. What is rural economics?
2. The Proper Adjustment of Rural and Urban Industry.
3. Conditions for Permanence or Stability of Agricultural Population.
4. The Effects of Borrowed Capital.

Professor A. Leitch of the Ontario Agricultural College will give two lectures in farm economics, the subjects for which have yet to be announced.

Dr. Bruce Macallum of Toronto University will give two lectures on "The Role of the Vitamine in Animal and Plant Nutrition". These will be illustrated with lantern slides.

The names of other subjects and speakers will be announced in the final programme. The committee is in communication with several prominent workers in the United States.

LUNCHEONS AND DINNER ADDRESSES

Prominent speakers have been invited to the Convention, and will address the members on the occasions indicated below. As these men cannot make binding engagements very much in advance, their attendance is subject to cancellation, but all have expressed their intention of being present at the time stated, unless unforeseen circumstances intervene.

Dinner, June 26th, Dr. F. C. Harrison, Principal of Macdonald College.

Luncheon, June 27th. Dr. James W. Robertson, Ottawa.

Dinner, June 27th. Hon. J. E. Caron, Minister of Agriculture for Quebec; Hon. M. W. Doherty, Minister of Agriculture for Ontario.

Luncheon, June 28th. Dr. J. H. Grisdale, Deputy Minister of Agriculture for Canada.

Banquet, June 28th. 7.00 P. M. Sir Arthur Currie, Principal of McGill University; Hon. W. R. Motherwell, Minister of Agriculture for Canada.

Dr. JAMES W. ROBERTSON

Dr. J. H. GRISDALE

Dr. F .C. HARRISON

Three prominent figures in Canadian Agriculture, who will attend the C.S.T.A. Convention. Dr. Harrison, Principal of Macdonald College, will formally welcome the members to the College at dinner on June 26th.

ROOMS FOR LECTURES, etc.

The following rooms have been set aside for meetings, etc.

Dominion Executive Meetings,—Room 28, Main Building.

Convention Committees,—Room 13, Main Building, and in Men's Residence.

Lounge Rooms,—too numerous to specify.

Business Sessions,—Room 107, Main Building.

Animal Industry Lectures,—Room 175, Physics Building.

Plant Industry Lectures,—Room 148, Biology Building.

Economics Lectures,—Room 148, Biology Building.

Presidential Address.—Assembly Hall.

Office of General Secretary (during Convention only) Room 2, Main building.

Exhibits,—Men's Gymnasium.

VISIT TO OKA

An important feature of the Convention will be a visit to the Agricultural College at Oka on Dominion Day, July 1st. Motor launches will take the members and delegates from Ste. Annes to the village of Oka—seven miles distant—where automobiles will meet them and convey them to the College. Father Leopold, Principal of the College, will be the host on this occasion. Members will find it well worth while to remain for this event.

EXHIBITS

Firms which have been advertising in Scientific Agriculture have been invited to send a representative to the Convention and to put up an exhibit that will be of interest to those in attendance. These representatives will also attend the session on the morning of June 27th when the editorial and advertising policies of the magazine are under discussion. In this way it is hoped to develop a closer union and more intimate relationship between the manufacturers of agricultural equipment and the trained workers in agriculture. This will be to the advantage of the Society and of the manufacturer.

LIST OF DELEGATES

Up to the time of going to press, the following official delegates have been appointed by the local Branches:

Alberta—D. H. Galbraith, Vulcan
C. E. Bain, Calgary

Manitoba—V. W. Jackson, Agricultural College, Winnipeg; A. C. McCulloch, Dominion Live Stock Branch, Winnipeg.

Nova Scotia.—W. H. Brittain, Provincial Entomologist, Truro.

Eastern Ontario—Arthur Gibson, Dominion Entomologist, Ottawa; G. H. Clark, Seed Commissioner, Ottawa; A. J. Logsdail, Agricultural School, Kemptville; A. P. MacVannel, District Representative, Picton.

Prince Edward Island—J. A. Clark, Experimental Farm, Charlottetown.

Quebec—J. A. Ste. Marie, Experimental Farm, Ste. Anne de la Pocatière; A. Godbout, Agricultural College, Ste. Anne de la Pocatière; A. Desilets, Dept. of Agriculture, Quebec.

Montreal—J. N. Ponton, Editor, le Bulletin des Agriculteurs, Montreal; Abel Raymond, Dominion Live Stock Branch, Montreal.

Northern Saskatchewan—A. M. Shaw, University of Saskatchewan, Saskatoon.

Southern Saskatchewan—J. F. Booth, Dept. of Agriculture, Regina; J. G. Robertson, Dept. of Agriculture, Regina.

Delegates from British Columbia, New Brunswick, Western Ontario, and Macdonald College branches have yet to be appointed.

FRENCH PROGRAMME.

The convention programme, as published in this issue, will be elaborated to some extent by the French-speaking members of the Society. There will probably be a special session in French on the evening of June 27th. Representatives of the University of Montreal and the University of Laval will be invited to attend the Convention and will address the members. Other details are under consideration and when arrangements have been completed they will be embodied in the final programme.

AFFILIATION WITH A.A.A.S.

At a meeting of the Council of the American Association for the Advancement of Science, held in Washington on April 23rd last, the Canadian Society of Technical Agriculturists was admitted as an affiliated Society. As such, it is entitled to one representative on the Council of the Association.

RECEPTION

Dr. and Mrs. F. C. Harrison will receive the delegates, members and guests informally at a garden party on the evening of June 27th.

CONVENTION NOTES

If you are planning to attend the Convention, notify the General Secretary at once. This is very important.

No banquets are being held in Montreal. The evenings of Tuesday, Thursday and Friday are open and members can visit Montreal in groups. It was considered advisable, in order to avoid confusion, to keep the Convention at the College.

President J. B. Reynolds will preside at all business sessions and will introduce all speakers at luncheons, dinners, etc.

Chairmen have yet to be appointed for the lectures in economics, plant industry and animal industry.

Special committees are attending to all local arrangements, and will guarantee that everyone coming to the Convention will be comfortably accomodated, well entertained, intellectually and physically nourished, and will leave with regret.

There are splendid tennis courts, swimming baths, a nine hole golf course, and other facilities for spending the evenings.

GENERAL NOTES

C. F. Bailey, (O.A.C. '09), formerly Manager of the Royal Agricultural Winter Fair, has been appointed Superintendent of the Dominion Experimental Farm at Fredericton.

W. R. Shaw (O.A.C. '16) has resigned his position as Live Stock Editor of the United Farmers' Guide, and is taking up farming at Clyde River, P. E. I.

Geo. Bouchard (Laval '08) Professor of Botany at the Agricultural College at Ste. Anne de la Pocatière and Vice-President of the Quebec local Branch of the C.S.T.A., has been elected Member of Parliament for the County of Kamousraska in the Federal House. He was elected by acclamation.

B. T. Dickson (Queens '15), Professor of Botany at Macdonald College, has recently received the degree of Ph. D. from McGill University.

A. Gagnon (Laval '19) has resigned his position with the Agricultural College at Latrappe and is now farming at Laprairie, P. Q.

The death is reported of J. E. Gosselin (Laval '17), district agriculturist for Rouville County, P. Q. His death occurred during the last week of April. The late Mr. Gosselin was a member of the Montreal Branch.

Armand Gelinas (Laval '20) has been transferred by the Quebec Department of Agriculture from Ste. Rosalie Junction to Bedford.

C. W. Baxter, Dominion Fruit Commissioner, has been appointed General Manager of the Niagara Peninsula Growers. He takes up his new duties on June 1st. It is unlikely that the position of Fruit Commissioner will be filled before the latter part of the summer.

B. T. DICKSON, D. Sc.
Professor of Botany at Macdonald College, who has received his Doctor's degree from McGill University. He is contributing a series of articles on "Diseases of the Potato" in the current volume of Scientific Agriculture.

The Second Annual Convention

From every point of view the second annual convention of the Canadian Society of Technical Agriculturists was entirely successful. The attendance was larger, the enthusiasm greater, the future prospects brighter, than at any previous meeting. At the business sessions, which occupied the greater part of the first three days under the chairmanship of J. B. Reynolds, excellent progress was indicated in every line of work, and the members seemed to appreciate the broader aspects of the Society's objectives, rather than to expect direct personal benefits. The fact that the financial state of the organization was sound and that a reduction in the annual fee to present members was possible, served as an additional source of satisfaction. The series of advanced lectures, which extended over three days, were well attended, and of great value and interest. So valuable was the information furnished by the lecturers that it has been decided to publish abstracts of the entire series in the next issue of Scientific Agriculture.

The social part of the programme was exceedingly well arranged. No detail was overlooked. The publication, twice during the convention, of a more or less satirical magazine under the name of "The Siesta", constituted a new feature and one which proved to be extremely popular. Excellent entertainment was provided at luncheons and banquets, as well as at specially arranged evening programmes. One whole day was spent at the agricultural Institute at Oka. The Reception and Entertainment committees deserve every credit for their efficient management of affairs.

In the following pages the major features of the business sessions are published. It is impossible to convey to every member the enthusiasm or "spirit" of a Convention. That will be done, in some measure, by the delegates and others who were present. All that can be done, through these pages, is to give our members a synopsis of the proceedings.

Amendments To Constitution

Article 3, Clause 2.—the following words were added "an associate member becomes a regular member, on attaining any of the qualifications provided for regular membership".

Article IV.—The word "provincial" to be changed to "local" so that the article will read to follows: "The officers of the Society shall be a President, two vice-presidents and honorary secretary-treasurer, who together with one member of each **local** executive, shall form the Dominion Executive of the Society".

This change was considered necessary in order to give each local branch direct representation on the Dominion Executive. While the formation of Provincial Executives remains optional, it has been found that they have not always been appointed and, when appointed, have not always functioned. The above arrangement will, under present conditions, increase the personnel of the Dominion Executive by four members.

The change cannot become effective until the Executive for 1923-1924 is appointed.

Amendments to By-Laws

By-law V was amended to read as follows:

"The membership fee shall be $10.00 for the first year and $6.00 for subsequent years, of which $1.00 shall go to the local branch".

There was a great deal of discussion on this amendment. The British Columbia delegates held out strongly for either the maintenance of the $10.00 fee for every member or a graduated fee which would vary with the member's income. It seemed to be felt, however, that a larger membership was necessary and that this could be accomplished by lowering the fee. The figure decided upon was about as low as present financial circumstances would warrant.

A change was made in By-law IV, clause 1, so that the Conventions need not necessarily be held in cities. This would make it possible to meet at agricultural colleges.

By-law 3, clause 4, was amended to read as follows:

"Where there are two or more locals in any province, these locals may form a Provincial Executive".

This change was made necessary by the change in Article 4 of the Constitution.

Editorial Policy

In introducing the discussion on the editorial and advertising policies of the Society's official organ, the General Secretary said:

"In an organization such as ours it is particularly difficult to produce an official organ that will meet with the approval of all members. This condition is aggravated when you rely upon advertising for your main source of revenue. There have been times, during the past year, when I was nearly driven to distraction over this matter of editorial policy. I hope many of my perplexities will be cleared away this morning.

Is the magazine to be entirely made up of advanced articles? If so, it will not be read with interest by more than 25 percent of our members. Is it to be entirely popular? It would then be read by at least 75 per cent. of the members but it would not be serving the purpose for which it is most needed, namely, as a medium for the publication, in Canada, of the results of agricultural research and experimentation. Can these two extremes be brought together under one cover? Can we have a technical section in the centre with popular matter front and back, next to the advertising pages?

Up to the present there has always been a shortage of material. This has made it difficult, and at times impossible, to submit articles to the Editorial Board. At the same time we have tried to be careful in selecting material, and we believe the magazine has been much more technical than popular.

It has seldom been possible to submit proofs to the author. This has been partly because the articles upon receipt had to go immediately into press, and partly because we had to be guided by labour conditions—often very serious. Many issues have been proof-read, by the Editor, from cover to cover, over night. Typographical errors were bound to appear under such conditions. In a magazine like Scientific Agriculture there should be no typographical errors.

Once we have sufficient material on hand, many difficulties will be overcome. We can submit proofs to authors and we will have ample time for proof-reading at headquarters.

A great many reprints have been printed in the past year. These serve a useful purpose in advertising the magazine, and we have been able to furnish fifty reprints without charge. We hope that arrangement can be continued.

The present dimensions of the magazine are not popular with the advertisers, but they were adopted as a result of the discussions at Winnipeg last year, and appear to be most suitable.

The cover should certainly be made more attractive, no matter what we do with the contents. A magazine often sells on its appearance and the present cover is too severe to make a wide appeal. It should be changed. An attractive cover can do no harm and will do some good.

The French section should be maintained. The French members are now taking hold of this and will develop it in many ways during the coming year.

The members of the Editorial Board have not all been active, but no one will blame them. They don't know what type of article is suitable and no one can tell them. With a clear cut policy I believe we will have ample material for every issue. The Editorial Board might well consider the possibility of submitting abstracts of the most interesting articles, in other magazines, which come to their notice during a given period, say every two months. A page or two of such material could be made a distinct feature.

Editorials are unnecessary, unless the Society is willing to use the magazine as a tongue for the expression of opinions on matters affecting the profession or any member or group of members. Even then it wants to be careful how it wags its tongue. There have been instances when the Society might well have taken a definite stand if, after making full enquiries, it was convinced in its opinions and prepared to express them. There will be similar instances in the future. Except in such instances, and for such purposes, editorials are unnecessary. I say that without any desire to avoid writing editorials.

Whatever policy we adopt it is important to bear in mind that Scientific Agriculture is an official organ and should be used as such. If all our members will take a generous, broadminded attitude, we can

SECOND ANNUAL CONVENTION OF THE CANADIAN SOCIETY OF TECHNICA L AGRICULTURISTS

Many prominent workers in Canadian Agriculture will be noticed.

make of it a very useful publication. It may contain technical and popular articles, it may have a more attractive cover, it may publish many personal items about members (these are always interesting) and so on. It can in this way meet the wishes of practically every member.

Advertising Policy

This is an entirely new subject in the discussions at our Convention. A year ago we had nothing to do with advertising. Today it is a factor of vital importance to our successful operation and will remain so as long as we require it as a source of revenue.

When we started to publish Scientific Agriculture under our own ownership last July, it became immediately apparent that we could not develop a circulation large enough to compare favourably with the circulation of other agricultural magazines. That removed the strongest argument of the average advertising solicitor. Other obstacles that had to be overcome were (1) the fact that the magazine had already failed under commercial ownership, (2) that we had no sample copy to show, (3) that we had no advertising contracts to boast about and (4) that we had no business connection with commercial firms and advertising agencies. Today we can show sample copies and we can name over forty large firms that have given us advertising contracts during the past year. Those two difficulties do not now confront us. In addition, we have established a personal acquaintance that is very valuable.

Those who have ever had anything to do with soliciting advertising for a new publication will sympathise with the General Secretary who had to go out last July and call on scores of firms for the first time. He had no idea of the type of man he would meet. He did know that the man would be very busy and that what had to be said must be said quickly. The repetition of this sort of thing day after day, month after month, became monotonous but it brought results. Each issue brought a larger amount of advertising than the preceding one. We now have about as much advertising as we need to carry our magazine. Whether we can keep it or not depends upon the extent to which every member is willing to co-operate in developing the policy we have adopted.

To take the place of circulation we have tried to sell service, to impress upon manufacturers the fact that our members influence a large buying constituency and that, as owners of this magazine, they are prepared to endorse every announcement in it. To give such an assurance meant that particular care had to be exercised in selecting firms. That has been done. We have not published any announcement to which exception could be taken.

Under such a policy as this, the amount of space taken by a firm was not of great importance. The permanence of the advertisement is of much more value. A quarter page in every issue of Scientific Agriculture is just as valuable to the advertiser as a full page in three issues. Our members often recommend spray materials and spray machinery to students and to farmers when both are "out of season". What we are attempting to do is to develop our advertising pages until every reputable firm and product is represented in them and at the same time develop an appreciation, on the part of our members, of the value to them of such a reference medium as is thus provided. In this way we place the influence of the profession at the service of our advertisers.

We have never appointed an advertising manager. It might be unwise to do so. In the case of our particular magazine, under our present policy, our advertising is almost an editorial feature. At the same time, there is no doubt that if we had a man soliciting advertising all the time instead of intermittently as has been the case during the past year, our revenue would be larger. There are more arguments against the principle, however, than there are in favour of it and the arguments are almost obvious. An advertising manager does not always get a hearing — an Editor usually does. An advertising manager would probably be working on a commission and might not confine his efforts to selected firms.

In addition to educating our members to an appreciation of the obligation they are under to the advertisers, and the value of our advertising policy to them, the advertisers themselves and advertising agencies must also be educated. They must realize that they are not reaching the con-

sumer direct. They are reaching the men to whom the purchaser or consumer goes for advice. They must not therefore expect direct results. I doubt whether there is any way of tracing the results obtained through advertising in Scientific Agriculture. Recently I have been told by advertising agencies, who use key numbers to trace results, that Scientific Agriculture is not "pulling" enquiries. How do they know it isn't? I know for a fact that many of our members are recommending firms and products that are advertised in Scientific Agriculture, but the advertiser will never learn that fact from the purchaser. He must take it for granted. All the advertisements in Scientific Agriculture should be addressed to the professional men, the type of men who are here this morning. Keep that announcement—in a small space if you like—before these men all the year round, and rely on receiving their influence as your return.

An exclusive policy is vital. That has already been made plain. If we can keep our magazine self-supporting that is all we should expect. Additional revenue should be put into the magazine by improving its appearance, increasing its size, publishing more photographs, etc. The more attractive the magazine the greater its value to the advertiser.

We have had a wonderful experience in the past year. We are familiar with the men we have to deal with. They are a good lot of fellows. Some of them are here this morning. We want them to know our members, to appreciate the work our organization is doing, and to take a personal interest in it. The development of agriculture in Canada is just as important to the manufacturer as it is to the professional workers. Surely it is possible to form a bond of union between them. Perhaps some of the advertising we have obtained has been given through sentiment—we do not believe so. And we believe that more and more our advertising policy, regardless of circulation outside of the Society, will become fully appreciated. It takes time to "put it across". This much is certain, if co-operation within the Society is developed, we can make a great success of our magazine; if it cannot be developed and maintained the danger of failure must be faced. We have done remarkably well already and we can do better. Once the reputable manufacturers realize that we are not a commercial institution but an organization attempting to advance the agricultural industry, they will come in with us and support us".

The discussion on the official organ, in which both advertisers and members took part, indicated that some changes were needed in the editorial policy. It was thought that the magazine should function mainly as a mouthpiece for the society. As such, it should keep the members fully informed concerning the operations of committees, the activities of local branches, the movements of individual members and so on. Strictly technical articles should be published in a special section of the magazine.

Regarding the advertising policy there was no difference of opinion. Advertisers themselves considered that the restrictive or selective policy so far adopted was the key-note of success and must be continued. A resolution to that effect was strongly endorsed by the Convention.

Bureau Of Records

The General Secretary introduced the discussion on the Bureau of Records in the following words:

"Some reference was made to the Bureau of Records in my annual report. From present indications, based upon the comparatively small period during which the Bureau has been operating, there is a great need for it in professional circles. Its value, however, has not yet been proven. The number of enquiries so far received from employers has been very small and in almost every instance these enquiries have called for a man with special, or graduate, training. On the other hand the number of enquiries from registrants seeking positions has been much larger and always from men who have no training beyond that leading to the B. S. A. degree plus subsequent professional experience. For this reason the value of the Bureau has been minimized. The men seeking positions could not be placed; the employers seeking men could not find them, at the salaries offered, among our registrants.

In spite of this, it is unfair at this early date, to say that the Bureau will not prove to be an important and valuable institution in course of time.

It needs more publicity. Up to the present time, no notification of its establishment has been sent beyond experimental farms, agricultural colleges, deputy ministers of agriculture and the Civil Service Commission. Apparently these institutions do not require the B. S. A. man, in any line of work, to the extent that they were required a few years ago. They want specialists. This means that the C. S. T. A. Bureau, to be thoroughly efficient, must include, among its registrants, a fairly large percentage of highly trained men, which is not the case now. The Society might also attempt to develop new fields for employment for the B. S. A. At present the graduate in agriculture is looked upon, in some quarters, as a book-learned individual, unpractical and inexperienced. This opinion can be largely removed by publicity and by encouraging commercial firms, co-operative organizations and other similar institutions, to employ agricultural graduates.

First of all, it must be understood by all concerned, that the Bureau is not intended to be a means of increasing salaries. It is merely intended to help men seeking positions, (of whom there are unfortunately a good many) and employers seeking trained men. Surely that is a useful service.

To be of the greatest value, efficient operation is essential. That means expense —and we have no funds. The registrants do not keep in touch with the Bureau; they frequently change their positions or their salaries, or both, and no report reaches the Bureau. The information obtained last November is, in some cases, already incorrect. To keep the record up-to-date means frequent correspondence with six hundred members. That takes time—and we have no time. With a staff of two, or even one, doing nothing else but attending to the development of the Bureau, it could be made quite efficient. Funds might be raised by making a charge when a man is placed, — (that is done in other similar Bureaus) — of his first week's salary. At present we cannot venture to engage a man, on a salary, to do that work, because we cannot guarantee that he will ever receive his salary.

The purpose of this discussion today is to obtain, from the average member, and from men holding higher positions, an expression of opinion as to how the Bureau of Records can best serve their particular class. If it is admittedly a useful institution, let us develop it as thoroughly as we can, relying upon the registrants to keep the Bureau frequently informed of their doings, and relying upon employing agencies to co-operate and to keep us advised of vacancies. If it cannot serve a useful purpose let us abolish it at once without further waste of time".

It was agreed by the Convention that the operations of the Bureau be given more publicity and that notices of men seeking positions and of employers seeking men, should be published in Scientific Agriculture, using key numbers in all cases. It was further suggested that the General Secretary should secure an efficient clerk to assist in developing the Bureau so that it would be of the greatest service, the expense involved to be met by charging members a nomical fee (one week's salary) when positions were secured directly through the Bureau. It was highly necessary that the Bureau be kept up-to-date and that records be complete.

Dr. F. C. Harrison, President of the Society of American Bacteriologists, an organization with 1200 members, stated that they had recently decided to establish a Bureau of Records in that Society. He urged that a close co-operation be developed between the C. S. T. A., and the Colonial Office, which frequently offered service, both in administrative and technical work, in all parts of the world.

Fellowships And Honorary Memberships

On the recommendation of the Dominion Executive Committee, a fellowship was conferred upon Dr. L. S. Klinck, President of the University of British Columbia and retiring President of the C. S. T. A.

Honorary Membership was conferred upon His Excellency, Baron Byng, Governor General of Canada.

Place For 1923 Convention

At the invitation of Dean W. J. Rutherford, the Convention unanimously agreed to hold the next Convention at the University of Saskatchewan, Saskatoon.

Committees

The complete list of committees appointed by the Convention and by the Dominion Executive Committees, is as follows:

Research: J. F. Snell (chairman), J. M. Swaine, W. Sadler, A. A. Dowell, W. P. Thompson, R. Harcourt, A.T. Charron, P. A. Boving.

Educational Policies: L. S. Klinck, (chairman), E. A. Howes, J. B. Reynolds, H. S. Arkell, M. Cumming, Father Leopold, F. C. Harrison, W.J. Rutherford, J. H. Evans.

J. B. Spencer was appointed, by the Dominion Executive, to act as a special subcommittee of this committee.

Marketing Education: A Leitch (chairman), W. A. Brown, A. C. McCulloch, J. N. Ponton, J. G. Robertson, E. F. Palmer, L. C. McOuat, F. M. Clement.

Graduate Study: R. Newton, (chairman), M. A. Jull, W. H. Brittain, M. Champlin, G. G. Moe, R. D. Colquette, G. Toupin, B. T. Dickson.

The above committee were all appointed by the Convention.

Finance: Arthur Gibson (chairman), J. G. Robertson, J. H. King.

Membership: L. H. Newman (chairman) Jules Simard, A. C. Mc Culloch.

Progress: H. Barton, (chairman) F. E. Buck, A. Désilets.

Affiliations: W. H. Brittain (chairman), D. H. Galbraith, Arthur Gibson.

Executive Council: J. B. Reynolds (chairman), L. H. Newman, Arthur Gibson, H. Barton, Jules Simard.

Local Branch Constitutions: P. A. Boving (chairman), W. H. Hill, D. G. Laird.

Associate Editors: J. B. Spencer, H.S. Arkell, J. M. Swaine.

These committees were all appointed by the Dominion Executive. The Committees on Finance, Progress, Membership and Affiliations are appointed each year and their duties are obvious. The Executive Council is intended to act for the Executive in all matters affecting the operating policies of the Society and to meet when necessary for the transaction of business. All its operations are subject to the approval of the Executive. The Associate Editors will assist the Editor in matters affecting the official organ. Both of these committees are new and, it is hoped, will assist materially in promoting greater activity and more rapid progress.

Dr. F. C. HARRISON,
Principal of Macdonald College, who welcomed the Convention on June 26th.

Report of Committee on Graduate Study

By Dr. F. C. Harrison, Principal, Macdonald College, P. Q.

Modern education has reached a very intensive stage. In the last fifty years the progress has been phenomenal. Discovery has trod on the heels of discovery, science has laid bare the secrets of nature, new sciences have emerged with a leap like Pallas Athene who sprang forth from the head of Zeus with a mighty war shout and in complete armour. In her power and wisdom were harmoniously blended, and our modern sciences quite fittingly take her place. Commensurate with this progress and advance of science, we have been brought to an age of specialism, as it is impossible for one man to master even the whole of a science, and the interlocking of many sciences has brought forth the necessity for broad and comprehensive training. For example, thirty years ago there was a Professor of Natural History and Geology at the Ontario Agricultural College. Some years later his work was divided and Professors of Horticulture, Botany, Entomology and Bacteriology were created. These have again been sub-divided in some of our Canadian institutions and the sub-division has been even more extensive in American Agricultural Colleges. For example, instead of a Professor of Botany there may be found Professors of Economic Botany, Ecology, Cryptogamic Botany, Plant Pathology, Algology, etc. Entomology has also been divided and we have Professors devoting themselves to a single order. This evolution takes place as intensively in other sciences, until teachers have found that it is impossible to cram into four years of undergraduate life, all that is thought necessary for such a man to know. Hence, in a number of faculties the course has been considerably lengthened. For example, in medicine six year courses are quite common, and after the completion of such a course a graduate walks the hospitals for several additional years. In some institutions the B. A. is necessary as a prerequisite to registration in medicine.

In law, the courses have been lengthened. In many institutions the B. A. is required for entering the study of law.

In arts, men who specialise in History, Economics, Education, are bound to go forward for advanced degrees if they desire to find situations.

In applied science, the same course is followed, e.g. chemical, mining and electrical engineers, etc., have to spend considerable time in apprenticeship before they can find situations.

How is it in agriculture? Let us first examine the field. Agriculture in many respects approaches medicine more closely. The sciences of Chemistry, Biology, Physics, Bacteriology, in their widest application, are the foundations on which both sciences are built. The undergraduate in agriculture has a very large number of subjects to assimilate. In addition to the sciences mentioned there are the professional subjects Animal Husbandry, Agronomy, Horticulture, Poultry, Farm Engineering, English, Economics, Mathematics. In the attempt to reduce the number of subjects, many institutions permit students to either specialize or select certain subjects in order to reduce the task of the student. Often the result is the building of a rather frail foundation in the science subjects, and the general result may be stated by saying that after four years of study, really amounting to about 32 months of lecture and laboratory work, the student is ready to go forward, and if of sufficient standing, to take up postgraduate work. But if the exigencies of medicine call for now at least six years work and more often seven and eight, surely agriculture needs as much for men who are to teach or do research work.

In a few words, the amount and nature of work in agriculture is now so large that it is impossible for the average student to obtain the necessary training and assimilate the necessary facts in four years of undergraduate work.

The field of research is vast, and the results that may be expected from well planned and properly carried out research have the added stimulus that such work is of high practical utility.

The soil offers many problems, its biological activities, the solution of the soil acidity problem in the east, and the probability of its relation to soil toxicity, clover sickness, etc., the aerial denudation of soils in the west, the quick decomposition of

vegetable debris like straw, the unlocking of soil fertility, the treatment of alkali soils, etc. With these are related problems in tillage, drainage, irrigation, dry farming, etc.

The plant offers inexhaustable problems, yields, early maturity, hardiness, breeding for disease resistance, breeding for certain chemical constituents; its relation to disease induced by fungi, bacteria and insects—methods of control and prevention, involving a profound knowledge of the sciences of Genetics, Biochemistry, Botany, Plant Pathology, Bacteriology, Entomology, etc.

The animal likewise involves problems in breeding and Genetics, Chemistry of Nutrition, Biochemistry, Veterinary Science. How much may the science of Biochemistry come to the assistance of the cattle feeder, How has the discovery of vitamines altered our conception of the feeding of the young and adolescent animal; the problem of calcium assimilation. Have we an intelligent conception of contagious abortion, of goitre and its causes, of methods of dealing with tuberculosis, and many more diseases to which all kinds of stock are subject?

The products from plant and animal, the problems of the dairyman in his provision of clean milk, good butter and cheese and healthy by-products.

Then there are the numerous problems connected with farm engineering, sanitation, drainage, mechanics of farm power, etc. Truly the number of subjects is vast and the opportunities many.

What are we doing to cope with these large and small problems? Are we seized with the importance of thoroughly training men to devote their time to such work? What kind of training should we give? How can we induce our graduates to see the importance of this work?—are some of the questions we may ask ourselves.

Two kinds of advanced work seem to be indicated:—

1. Preparation for teaching including not only training of men for teaching in our Colleges, but also training for extension work, which in the final analysis is a form of teaching.

2. Preparation for research work.

In both the immediate aims differ from those of undergraduate study. The graduate student must learn to develop the power of independent work, to become filled with the true spirit of research, to specialize without becoming narrow, to read widely and become familiar with the literature of his chosen subjects.

With regard to teaching or degrees for agricultural education, it may be noted that in certain institutions in the United States, a very large number of Doctor's degrees are granted every year in the subject of education. Columbia and Chicago, to mention two institutions, have very numerous students taking work in higher education. We need a degree in agricultural education, we need men who, while technically well supplied with material facts need extensive courses in the principles of vocational education, in methods of teaching, practice of teaching and research in education. Even if we do not go so far as the Doctor's degree, more might be done to equip men by an extra year's training in the subjects above mentioned. Men with this training should also be able to give better service in extension work, as they would know how to present their subjects in the best manner to a farmer audience.

For research men who desire to take either their Master's or Doctor's degree, course work, the acquisition of a reading knowledge of two languages and a problem or thesis showing distinct originality, together with a mastery of the literature of the subjects chosen, are the usual requirements for any kind of degree, but no matter what line the student may elect in agriculture, he is practically forced to take intensive courses in one or other of the sciences. For example, if he desires to go forward to an advanced degree in Animal Husbandry, he will need a thorough grounding in Genetics including the cell, cytology and embryology. In Nutrition he will need Animal Chemistry, Biochemistry, the Physiology of the Digestive Glands. The same is also true for men who desire to specialize in Poultry.

The Horticultural specialists will need courses in Genetics, Botany, and one or other of its sub-divisions, the Chemistry of Soils and Fertilizers.

Students who desire to specialize in the soils will find a very heavy programme of work including Chemistry, Biochemistry, Physical Chemistry, Zoology, Bacteriology.

Crop or Agronomy specialists will need Genetics, Chemistry, Biochemistry, Botany, etc.

It will be seen, therefore, that the sciences are absolutely fundamental for any of the so-called practical branches of agriculture, and when we turn to the sciences we shall find that it is now necessary for even specialists to have a wide knowledge of more than one science because of the interlocking of subjects, special problems often involving a thorough knowledge of Bio-chemistry, Physical Chemistry, Botany, Bacteriology, etc.

Our Agricultural Colleges or Faculties of Agriculture of Universities, Government Departments needing scientific help, are looking for well trained men, men who have not only their B.S.A. degree, or its equivalent, but who have something further. Teachers are required who understand how to teach. Research men are needed who can conduct independently original research.

At the recent Universities Conference held in Winnipeg, great attention was given by the Conference to the problem of the research man, and it was thought that all our Universities should do what they can to train Canadian students. Certain Universities have recently established graduate faculties, and it was voted by the Conference that the subject of the greatest importance for the next discussion was the subject of graduate work. Several Deans of Agricultural Faculties deplored the lack of trained men and stated that they had to go to the other side to find them. The Dominion Government recently wanted men in certain lines for expert work, but could not find them in Canada with sufficient training. Hence, it seems that not only must Canadian Colleges do something to supply this demand, but we must also induce more B.S.A.'s to take up graduate work. A start has been made in some institutions. The Faculty of Agriculture of the University of Saskatchewan has granted several scholarships and has placed on its curriculum a number of graduate courses.

Recently, McGill University has reorganized its Graduate Faculty, and due attention has been given to a number of agricultural subjects in this Faculty. The degrees offered are those of M.S.A., M.Sc. and Ph.D., and graduate students can specialize in Agronomy, Bacteriology, Chemistry, Entomology, Plant Pathology, and Poultry, and it will be possible for students to use both the resources of McGill University and those of Macdonald College.

At Macdonald we are well equipped for graduate work. There are twelve men on the staff with advanced degrees, nine of them with their Doctor's degree. There are excellent laboratories and good accommodation. The situation of Montreal as the export centre of Canada gives many facilities for those who desire to study marketing. Both French and English languages are spoken, permitting students to acquire a knowledge of a second language with little difficulty. Good individual attention can be given to students, and it is hoped that this Canadian effort will be appreciated by those desiring to take up postgraduate work.

Report of Committee on Marketing Education

Presented by H. S. ARKELL, Dominion Live Stock Commissioner

During the past year, the Chairman of the Committee has visited, with one or two exceptions, all of the Agricultural Colleges in Canada and has discussed the development of our work in Agriculture with the Presidents or with Professors from all these institutions. He has, therefore, had an opportunity of forming opinions with respect to the present status of our commercial agricultural education, which would seem to be of some value as the basis for the report of this Committee. Fortunately, in connection with addresses to and discussions with a rather considerable number of agriculturists in the different provinces, he has been able to check the conclusions reached with the views of men, including farmers themselves, doing important work in the various phases of agricultural development. Unfortunately, for various reasons, he has been unable to submit the report for final ratification to the members of the Committee. He presents the report, therefore, with all due deference to the members of the Convention, as embodying observations and perhaps convictions of one who, while not immediately engaged in College work, continues to take a very keen interest in its development and

in the report endeavours to interpret a large body of opinion now current in the country.

The one outstanding problem of agriculture today is—How to make money out of farming. By that is meant—How can the farmer make a comfortable living for his wife and family? Is it the duty of an Agricultural College in its teaching policy to tackle this problem? Is it doing it?

No attempt will be made to argue the answer to the first question. The writer has assumed that it must be in the affirmative, otherwise it were better to admit at once that the objective of College policy is cultural and scientific rather than commercial in character. If it be granted that the aim of College teaching accepts responsibility for this fundamental problem of every farmer in the country in the training it gives its students, then it is proper and necessary to consider how effectively this task is being discharged.

Such observations as the speaker would present may be set down concisely as follows:—

1. The actual responsibility or obligation to provide commercial demonstrations of economic efficiency in farm business seems to be generally lacking in College policy.

2. The policy in practical experimentation does not, speaking generally, appear to be sufficiently related to immediate marketing problems or tested by actual demonstrations of the practicability of results on a commercial cost vs. revenue basis.

3. Scientific investigation is not developing the confidence it deserves for the reason that, while important work has been done by technical men in the field, those who are charged with the direction of such investigations at our Colleges would appear to be better trained to pursue purely scientific inquiries than they are to find ways to promote the extensive adoption of accepted scientific methods in the ordinary commercial practices on the average farm.

4. The teaching of marketing work would seem to be too far disassociated from present day business problems either of production or of marketing, for the reason that those charged with the responsibility for carrying it on have too little opportunity for relating themselves to or studying at first hand the common or critical problems of those immediately engaged in making a living on the farm.

5. The analysis of the above observations and the logic of the inquiry that the Chairman of this Committee has been able to make during the past year leads to the conclusion that the training, purpose and personality of the teacher of marketing education is immensely more important than the formulation of the courses which he shall offer. The speaker is strongly of the opinion that herein lies the most important consideration in connection with this whole question. In his mind the greatest weakness at the present time is not in the men who are doing or trying to do this work but in the opportunity that is provided them of intimately associating themselves with the progress and problems of production and marketing in order that they may keep their work in line with present day commercial developments and in order that they may speak with knowledge, conviction and assurance. Almost without exception the men with whom conversation was held were alive to their responsibilities but deplored the fact that they were seriously restricted in their opportunities to familiarize themselves with present day marketing conditions or even to keep in touch with the business position of the farmer on his own farm. These opportunities represent the *sine qua non* of advancement in commercial agricultural education and given these the men will find the way to do the work.

By way of recommendation, the Chairman of the Committee would suggest that the policy in each College should be worked out locally. In this connection he would repeat the recommendation made by this Committee a year ago, namely that the work in marketing education should be given by the practical departments. It is only fair to say that with this opinion all the members of this Committee do not agree, the view being held by at least one member that the work should be organized under the direction of a professor of agricultural economics. The speaker believes, however, that it is a fundamental principle that the teaching of commercial agriculture should be assigned only to those who have or can be given a business responsibility in connection with the organization of their courses. This is an absolutely essential check to thinking and to practice under the test of present day economic conditions.

In the speaker's opinion, each College would do well to review and perhaps reconstruct its experimental and production work as against the obligation to demonsrate practical efficiency on a cost vs. revenue basis. How to make money out of steers or pigs or poultry or dairy cattle or potatoes or onions or fruits is the finest experiment that can be attempted and there is nothing that will place a teacher of technical agriculture in such vital contact with the difficulties of the farmer or in a better position to appreciate, study and represent the problems of marketing. Then, if he is given the opportunity to make and maintain a personal connection with the producer, on the one hand, and to keep posted as to marketing methods and market requirements on the other, he is in a position to assemble a body of information out of which will come convictions and confidence such as will make him a real leader in directing the training of his students in commercial agriculture. That he should also be a close associate of Provincial Departments in developing policies of production and with the Federal Department in organizing policies of marketing is also of paramount importance.

Last year, in the Committee's report, attention was directed to Marketing courses. This year special recognition is given to the men who are to give these courses. How their position may be improved either by consideration of the matter within each College, by joint discussion amongst themselves or in association with Provincial and Federal officers within each Province may well be considered by this Convention.

C. S. T. A. DOMINION EXECUTIVE COMMITTEE, 1922-23

Left to right, front row: J. A. Clark, Charlottetown; W. H. Brittain, Truro; Jules Simard, Quebec, (Vice-President); J. B. Reynolds, Ontario Agricultural College, Guelph (President); H. Barton, Macdonald College (Vice-President); L. H. Newman, Ottawa (Hon. Secretary-Treasurer); Fred H. Grindley, Gardenvale, P. Q. (General Secretary).
Back row: P. A. Boving, Vancouver, B. C.; Arthur Gibson, Ottawa; A. C. McCulloch, Winnipeg; D. H. Galbraith, M. L. A. Vulcan, Alta.; J. G. Robertson, Regina; J. K. King, Moncton.

Presidential Address

BY L. S. KLINCK,
President of the University of British Columbia, Vancouver

It is in a spirit of satisfaction at much good work accomplished that I rise this evening to deliver the Presidential Address at this the second annual convention of the Canadian Society of Technical Agriculturists.

Two years have passed since the Society was organized. Although the movement arose naturally and spontaneously, there was not a little suspicion and prejudice and a great deal of indifference to overcome. Confidence had to be created; objections had to be met and the thick atmosphere of doubt which prevailed in some quarters had to be dispelled. As a result, the Society was on trial during the first year of its existence.

The first annual convention, which was held last year in Winnipeg, allayed, but did not wholly dispel, the fears of the more conservative. The Society, they said, had grown too rapidly. Slow development they regarded as half-sister to wisdom. They thought that an organization of such gourd-like growth would naturally be short-lived and its influence problematical.

This evening, I think all those who questioned the wisdom of forming the Society have ample evidence to justify them in a change of attitude. Time has demonstrated that the organization was not the creation of the exigencies of the moment, but the mature and considered outcome of a Dominion-wide sentiment.

Each year since the organizing convention, the measure of the Society's opportunities has become increasingly evident, and the record of work accomplished is the highest tribute that can be paid to the splendid idealism and the sound, practical judgment of those who were responsible for the calling of the Ottawa meeting in May, 1920. Some have regarded these men as having been too optimistic; others, as not having been optimistic enough. However that may be, I do not think that the boldest among them have ventured to predict a gathering such as this within a little more than two years from the time the call for the first national convention was issued.

The progress made during the past year has not been spectacular, but it has been steady and uninterrupted. Since the Winnipeg Convention, the Society has strengthened its position, has made some notable advances, and has consolidated its gains. The record of the work accomplished since the last annual meeting, as set forth in the report of the General Secretary-Treasurer this evening, is a most gratifying one, not alone because of the measure of success achieved, but also because it foreshadows a future bright with promise.

During the year the scope of the Society's activities has been extended and enlarged. Objectives which were not so immediate and pressing as those taken up at the organizing convention have received consideration. The locals have become better organized; and provincial workers, without respect to departmental affiliations, have evinced new interest in the study of the wider aspects of agricultural education and agricultural organization as those relate to provincial needs or to those of national import. These studies, prosecuted in a broader spirit and in a more systematic way than heretofore, have proved most stimulating and suggestive and have gone far toward bringing about a better undestanding among technical agriculturists in Canada.

In the local conferences which have been held, a serious attempt has been made to discover and to apply the main principles which underlie the more closely related problems to which agriculturists are directing their attention. By this means the working interest of the members has been sustained and greatly increased. Nowhere is there evidence of waning enthusiasm. The objectives of the Society still present. The freshness of a new appeal.

I would not have you infer from this that the duties of the Dominion Executive have been purely nominal. Many difficulties incident to the inception of the movement, although not peculiar to it, have been met and some of them have been successfully solved. Your Executive has not always given evidence of "wisdom incarnate", but again freedom of action has been justified of her children. Responsibility, when delegated, has been gladly assumed and I trust, has been unreservedly respected. There remains, however, much

hard, pioneer work for the incoming Executive; and still, as always, the imperative need exists for the united support of the entire membership.

In expressing my deep, personal appreciation and thanks to those members who have been most closely associated with me during the past year in carrying out the Executive and administrative duties of the Society, I am performing a pleasant task, not discharging a purely perfunctory duty because it is a recognized part of formal procedure.

Ordinarily, no further words of appreciation would be necessary, but simple justice requires that special mention be made of the services rendered by the General Secretary-Treasurer. During the past two years this officer has developed a capacity for affairs which has been of the greatest assistance to your Executive. Initiative, resourcefulness and an almost passionate devotion to work have characterized all his relations with the Society. To him was given the task of following every trail, of exploring every by-path, of turning every stone and of looking into every suggestion which gave promise of furthering the best interests of the Society. How well he has succeeded in this difficult undertaking I confidently leave to your judgment.

Previous programs of the Society's conventions have been of a high order and keen indeed would be the disappointment if each succeeding one did not register a definite and demonstrable advance. The program for this convention, you will agree, registers such an advance. During three days of the convention, we shall have the opportunity of hearing and discussing the considered addresses, papers and reports which will be presented; and for an equal length of time it will be our privilege once more to become students and to attend the lectures given by distinguished specialists whose presence with us has been made possible through the co-operation of the Dominion Department of Agriculture.

These regular and special features, together with the consideration of resolutions, of proposed changes in the constitution, of business in connection with determining the policy of the magazine, of consideration of the question of membership fees and of other important matters of business on the program, give promise of sessions of more than usual interest and value.

One of the chief benefits arising from a convention such as this, quite aside from the papers read and the addresses given, lies in the interchange of ideas and in the comparison of experiences. Contact with men of widely different training, and with equally widely divergent points of view, helps to overcome the effects of enforced isolation, makes vital contributions to our knowledge and, by stimulating the enquiring mind, enables us to give fresh interpretations to old and long-familiar facts. Under these conditions, points of divergence prove a no less fascinating study than do points of similarity or of actual coincidence. From the younger members we, who are older, gain something of originality, enthusiasm and energy. We are not unconscious of the fact that we are apt to be deficient in these qualities; neither are we unmindful of what, to the younger members, must not infrequently be a still more obvious fact, that progress is often more rapid than we change in our attitude towards it. Those of us who have reached, shall I say forty, are, therefore, glad of an opportunity once a year to fall in step with the younger workers and, for a few days at least, try to march abreast of the times. Gladly we accord to these members this deserved recognition and in all modesty express the hope that the free exchange of ideas may be mutually beneficial.

This personal contact of man with man not only enkindles enthusiasm, but helps us the better to realize the magnitude of our task and the imperative need of planning for the future as well as of working for the present. Such contact, while emphasizing the urgent necessity for greater specialization, also makes us more conscious of our dependence on each other. The common cause, we are reminded once more, can only be advanced by concerted action. The task is too great to be carried out in isolation; it must be done co-operatively.

This opportunity for unofficial exchange between men engaged in the same or closely allied work, enables us to learn the problems of our contemporaries and to study their methods of attack. It does more than this: It shows us that the writers of bulletins, blue books and official reports are themselves human beings—sometimes very human. As a result of this discovery, the barriers of official reticence are broken

down; friendships, personal and professional, are established and a desire for conscious, well-considered co-operation is created.

As a means of keeping us in touch with what our fellow-workers are doing, the annual convention, in my considered judgment, comes second only to the magazine. We need to meet together at regular periods to compare notes and to take council together. A properly organized and conducted conference becomes a clearing house for investigational, teaching and administrative ideas. A convention such as this furnishes the occasion. It rests with us to determine to what extent we avail ourselves of a splendid opportunity.

In connection with the preparation of the reports of standing committees, I wish to emphasize the importance of early action and of composite judgment, based on the broadest foundation of experience. The chairmanship of a standing committee is one of the most important appointments in the gift of the Society, and membership on such a committee offers an unequalled opportunity for constructive work. Addresses, papers and discussions are valuable, and a convention could not be successful without them; but, in my opinion, the greatest possibilities for creative enterprise rest with the membership in the more important committees. With this view the majority of members, so honored, are in accord; but, unfortunately, some have not yet been seized of the importance of this basic fact.

Committee appointments generally go to the busiest members, and as these men necessarily work under high pressure, there is sometimes a disposition on their part to defer action until shortly before the convention. This generally results in members of a committee having little or no opportunity to confer with one another, not to mention their inability to consult with the members who are not on the committee but whose suggestions, not infrequently, would prove of great assistance and value. Moreover, composite judgments, which have slowly assumed concrete form, and which have crystallized over a period of months, will almost certainly be more valuable when submitted to the convention for final consideration and action, than the less composite findings of a small committee can possibly be, no matter how able its personnel.

The heart of this Society , as I conceive it, lies in its committees and in their findings. We have a right to expect from these committees not only an exhaustive, critical and discriminating analysis of the questions dealt with in their reports, but also that the subjects under consideration be given creative, constructive and synthetic treatment. From the Executive and from our standing committees must come, in large measure, the expression of the dynamic within the Society. Not only must we appoint our ablest men to these responsible positions, but we must also make provision for registering, through them, the best ideas and suggestions of the entire membership.

It is not my intention to range far and wide over the fields of discussion which will be opened up by the consideration of the reports which are being submitted to this convention. But if you are indulgent you will perhaps allow me, while not concealing my own point of view, to refresh your memories by means of a brief survey which is designed to bring under review the salient objects and accomplishments of the Society. No attempt will be made to deal specifically with new or impending developments in the organization. Minor details which have no application beyond a limited radius I shall not consider; but I shall confine my attention to the measuring and appraising of those factors which, to my mind, should determine our future course of action.

Permit me then very briefly to remind you, even at the risk of restating what I have said on previous occasions, that there have been, still are, and for years in all probability will continue to be, three paramount issues before this Society; viz: "Agricultural Education", "Agricultural Policies" and "The Organization of Technical Agriculturists".

Of secondary, and even of tertiary issues, there are many. These will demand and will be accorded varying degrees of attention from time to time as circumstances require; but the three major issues will, I venture to think, never be more than momentarily overshadowed. These three I have arranged in what I conceive to be the order of their relative importance. Around these major issues, the discussions at this, as at previous conferences, centre. Each is a wide field in itself, capable of many divisions and subdivisions. The appoint-

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assuming more concrete form. Strict adherence to these principles will result in the Society growing in influence, in prestige and in power. Past records justify us in cherishing high hopes for future accomplishments. In passing on to you, Sir, the duties and responsibilities of the highest office in the gift of the technical agriculturists in Canada, it is with the confident assurance that the days of the Society's greatest usefulness to Canadian agriculture belong to the future.

WEST MEETS EAST AT C. S. T. A. CONVENTION

L. S. KLINCK, President of the University of British Columbia and retiring President of the C. S. T. A. (left); and J. B. REYNOLDS, President of the Ontario Agricultural College, newly elected President of the C. S. T. A., at the Annual Convention of the Society

Report of the General Secretary-Treasurer

Presented at the Second Annual Convention, June 26, 1922

The following report will outline, as briefly as possible, the work of the Society during the past year, the difficulties that have been met and the progress that has been made. It will also contain certain recommendations and suggestions for the serious consideration of this Convention.

The several lines of work that have been carried on through the central office are so closely related that it is necessary to embody several reports in one. These reports cover the géneral operations of the Society, including a financial statement, as well as the editorial, advertising and circulation work in connection with the official organ. This main report will be supplemented by more detailed information at appropriate times during the Convention.

At the Winnipeg Convention the establishment of a Bureau of Records was proposed. The preliminary work occupied considerable time and it was not until November that questionnaires were mailed to the members. These questionnaires were prepared in French and English. Only a small number were returned promptly and several follow-up notices had to be mailed subsequently. By March 15th 75 per cent of the members had responded and on that date notice of the establishment of the Bureau was mailed to Federal and Provincial Departments of Agriculture, Agricultural Colleges and Experimental Farms. A number of enquiries were received and the usefulness of the Bureau was generally admitted. Before giving it any further publicity, and notifying other employing agencies of its establishment, further discussion of its operating policies is necessary. Provision has been made for such discussion in the programme of this Convention. There is no question that, with proper development and efficient operation, and provided that the co-operation of all parties concerned can be obtained, the Bureau of Records can be of great service to the members as well as to the various employing agencies seeking trained men. It is apparent from the enquiries so far received, however, that the demand for men with special training is increasing, that the old channels in which graduates formerly found employment are closing up, and that either new fields for employment have got to be developed or many graduates will have to pursue their studies further before finding employment at adequate salaries. The C. S. T. A. can do not better service than to encourage advanced studies and, if possible, to facilitate the taking of such studies by qualified members.

Early in April last negotiations were made with a number of publishing houses in an effort to obtain, for the members, the privilege of purchasing agricultural text books at a reduced price. It was felt that this would be a distinct service. The outcome of these negotiations was the formation of an Agricultural Text Book Club in the office of the General Secretary, through which any member could obtain these books at a discount of 20 percent from list prices. Twelve of the largest publishing houses in Canada and the United States agreed to this arrangement. It was announced in the May and June issues of *Scientific Agriculture*, but as yet few members have taken advantage of the privilege. Unless further interest is taken in it the publishers will probably discontinue the arrangement, since its permanency depends upon volume of business.

During the year the Society has lost 75 members. Of these 26 were in the form of written resignations and 49 were struck off the list for non-payment of dues. In the latter cases at least three letters were sent to these delinquents without acknowledgement before they were considered as resignations.

In this connection some reference must be made to the $10.00 annual fee. There is no doubt that, with its present membership, or even with a membership considerably larger, the Society would now be in debt if a lower fee had been adopted during the past two years. It is equally certain that the $10.00 fee has been the direct cause of 90 per cent of the resignations, that it has kept a large number of eligible members from joining and that a fairly large proportion of our present members paid the fee last year with reluctance and criticism. It seems

unfortunate that, just when we appear to be firmly established financially and in a position to set aside some profits for useful lines of work, these profits may have to be applied to a comparatively small reduction in the annual fee; the experience of the last year, however, is convincing. If the ultimate success of the Society depends upon a large and enthusiastic membership body, some reduction in the membership fee appears to be imperative, even if the operating policies of the Society have to be changed accordingly.

During the year the Society has lost four members by death:

A. J. M. Bélanger who died on September 5, 1921.

F. W. L. Sladen who was drowned on September 10, 1921.

Cecil R. Klinck, who died on February 25, 1922

J. E. Gosselin, who died on May 6, 1922.

Since June 1, 1921, 91 regular members and 11 associate members have been admitted.

Delegates to this Convention, appointed by the various branches, are as follows:

Alberta.—C. E. Bain, D. H. Galbraith.

British Columbia. — P. A. Boving, R. C. Treherne.

Manitoba.—J. E. Blakeman, A. C. McCulloch.

New Brunswick.—J. K. King.

Nova Scotia.—W. H. Brittain.

East Ontario.—A. Gibson, G. H. Clark, A. P. MacVannel, A. S. Logsdail.

West Ontario. — R. Harcourt, A. Leitch, E. F. Palmer.

Prince Edward Island. — J. A. Clark.

Montreal.—A. Raymond, J. N. Ponton.

Quebec — J. A. Ste. Marie, A. Godbout, A. Désilets.

Macdonald.—H. Barton, M. A. Jull, L. C. Raymond.

N. Sask.—M. Champlin.

S. Sask.—J. G. Robertson.

On April 23rd, at a meeting of the Council of the American Association for the Advancement of Science, held at Washington, the Society was admitted to affiliation with the Association. As an affiliated Society it is entitled to one representative on the Council of the Association, and this representative will be appointed by your Dominion Executive at the close of this Convention.

Plans for the Second Annual Convention were started in March last. It was decided at first to hold the Convention in Montreal but subsequently, as the result of a resolution passed at Guelph on April 11th, and with the approval of the Dominion Executive and the French members, the place of Convention was changed to Macdonald College. It was also learned that the Dominion Department of Agriculture was willing to assst financially in arranging a course of advanced lectures in economics, animal industry and plant industry, and a special committee was appointed to invite speakers and select subjects for these lectures. Several other committees have been actively engaged in attending to many details in connection with the programme. The success of the Convention, in a large measure, is due to the efforts of these various committees.

In addition to the financial assistance given by the Dominion Department of Agriculture, a generous grant was provided by the Quebec Department of Agriculture to cover the costs of all entertainments at the Convention and of the dinner on the evening of June 27th. Macdonald College provided the banquet on June 28th.

While the past year has been, in the main, successful, it has been a period of grave uncertainty and serious responsibilities. This was made necessary on account of unforeseen circumstances which demanded immediate action. That the outcome has been successful and that the Society is financially sound, in spite of many difficulties and discouragements, is almost miraculous. Perhaps no one outside of the members of the Dominion Executive Committee fully appreciates the conditions that have had to be met during the past year.

The taking over of *Scientific Agriculture* in July, 1921, and the subsequent development of that magazine to a self-supporting basis, constitutes a major feature of the Society's activities during the past year and is therefore given prominence in this report.

When the last Convention was held no suggestion had been made by the former publishers that suspension of the magazine was contemplated. Such a condition was therefore not discussed. Shortly after the Convention had adjourned (on June 21st) the General Secretary was informed that publication of *Scientific Agriculture* would

be suspended indefinitely on June 30th. This was made necessary because of the serious industrial depression which had prevented the owners of the magazine from obtaining sufficient revenue to cover the cost of publication. This depression showed no indication of improving.

During the latter part of June and the early part of July, the Vice-president and General Secretary had several interviews with the Industrial and Educational Publishing Company, (the former publishers) and consulted the members of the Dominion Executive by telegram and by mail. It was admitted that an official organ was vital to the Society and that its suspension, particularly at the beginning of a new year, would have a serious effect upon the membership. Full consideration was given to the financial responsibilities involved.

Scientific Agriculture became the property of the Society on July 15th, 1921. All outstanding liabilities were written off by the former publishers. There were no advertising contracts to transfer. The estimated cost of publication was $450.00 per month which had to be borne by the Society as a new expense. You will perhaps appreciate the anxiety of the members of the Dominion Executive at this particular period. Business depression was at its height. We had no advertising contracts. We had no available funds to meet even temporary financial losses, and we had no staff to handle the additional work involved. It also seemed necessary, in view of the criticism of the $10.00 annual fee, to bring the magazine up to a point where the advertising revenue would more than cover the cost of publication and could be used to cover some of the Society expenses now borne by the members.

Under these circumstances operating expenses had to be kept as low as possible, no additional staff could be employed and the first issue had to be published just as quickly as possible.

On August 25th, six weeks after the transfer, the first issue under Society ownership appeared. It contained forty pages and the dimensions had been reduced to conform to other similar publications and to meet the wishes of members, as expressed at the Winnipeg Convention. A restrictive advertising policy had been adopted so that the advertising pages could be used as a guide, by the members, to reputable firms and products, and would be creditable to the Society.

The first four issues were discouraging. The required advertising revenue had not been reached and the industrial depression was still keen. But during these four months a great deal of advertising campaign work had been done. Many reputable firms and advertising agencies in Ontario and Quebec had been interviewed and hundreds of letters had been sent throughout the Dominion.

In January we turned the peak. The succeeding five issues wiped out the deficit on the first four issues, the size was increased to 48 pages, and the magazine during its first year covered all the costs of publication and produced a small profit. It will also be seen that the magazine has assumed every expense that could fairly be charged it.

The General Secretary has not travelled outside of Ontario and Quebec. Most of this was in connection with advertising, but several local meetings of the Society have also been attended.

Advertising and circulation are vital to the financial success of the magazine. Most of our present advertisers have taken space in *Scientific Agriculture* because it is owned by the C. S. T. A. and because of the influence our members exert upon the farming constituencies of this country. They believe our members will appreciate the financial assistance given to the Society, and will use the advertising pages of their official organ as a reference medium or, in other words, that the Society and the advertisers can be of mutual service. But a larger circulation, outside of the Society, must be built up and that perhaps can best be done by the local branches.

There have been several criticisms of the magazine and of the Society. These are mentioned briefly here:

The Society is not accomplishing definite results;

There have been several typographical errors in the magazine;

The cover is not attractive;

The magazine is too technical;

The magazine is not technical enough;

Advertisements and circulation should be of secondary importance;

Proofs of articles should be submitted to the author;

Personal items about members should not be published;

The magazine does not give expression to the attitude of the Society towards public affairs;

The Society does not protect or take care of the interests of its members;

No French articles should be published;

More French articles should be published, etc., etc.

These and other criticisms have reached the General Secretary during the past year. They indicate a diversity of opinion. Some are justified, others are not. Some can be met, other cannot.

Every member should, first of all, appreciate the difficulties under which we have been operating. It has not been possible to make full use of the Editorial Board because of dearth of material; that situation is improving. Labour troubles have seriously affected the quality of the magazine. The General Secretary has had to assume, in addition to his Secretarial duties, the duties of advertising manager, circulation manager, editor, filing clerk, book-keeper, etc. This has involved a tremendous amount of correspondence and routine work and has prevented the efficient carrying out of any single line of effort. These conditions are all due to lack of funds and if our first profits must be applied to a reduction in the membership fee, we must be prepared to carry on the financial struggle for at least another year, with low operating expenses.

Financial stability is necessary; a large membership is necessary. If we cannot have both at once, it is perhaps best to first maintain and increase our membership on a smaller fee, and gamble on the finances. There is some consolation in the fact that we have been financially embarrassed for two years—at all times—but we have managed to pay our bills and maintain a credit in the bank.

In closing I should like to plead for closer co-operation within the Society. In all lines of work, whether it be advertising, circulation, the operations of committees, the development of policies, the contributing of articles and all other lines of progress, individual effort is almost fruitless. No General Secretary, whoever he may be, will shirk his duties and responsibilities, but if the Society is to prosper and accomplish results, every member must take a personal interest and do what he can to help. This spirit has been noticeably lacking during the past year and has had a discouraging effect.

There is no doubt that the danger period in the history of the Society has been passed. New problems and new fields for work are constantly presenting themselves, but in their solution or accomplishment action must be uniform, representative, wholehearted and energetic. There is a great future ahead of this new organization. There is a distinct place for it and for its official organ. Both are receiving recognition in all parts of the world. Let the members see to it that it continues to prosper and that they can share the credit for its prosperity.

The General Secretary wishes to acknowledge his appreciation for the excellent voluntary service rendered by the members of the Dominion Executive, the Editorial Board, the local secretaries and the various committees, to many individual members for helpful suggestions and constructive criticism, and to the Industrial and Educational Publishing Co., for many courtesies in connection with the publication of *Scientific Agriculture*.

Committee on Research

The report of the Committee on Research, presented by Dr. J. F. Snell in the absence of Dr. J. M. Swaine, included a complete list of problems requiring investigation, in all branches of agriculture. Owing to lack of space, the report cannot be published in this issue, but will either be embodied in an early issue, or printed as a bulletin for distribution to all members and to others on request.

During the coming year, the Committee on Research will endeavour to obtain more detailed information which will indicate the problems already under investigation, the place where the investigations are being carried on and the names of the investigators. This information will be published from time to time in *Scientific Agriculture*.

Committee on Educational Policies

It has been impossible for this Committee, in the time at its disposal, to make a complete survey of the educational policies in effect in all provinces. The report, as presented at the Convention, was therefore incomplete, although it contained much valuable material. It has been considered advisable to withhold publication until a complete statement is available.

Committe on Graduate Studies

This Committee, appointed at the Ottawa Convention in 1920, made no report at the Winnipeg Convention last year. In view of the statement made by Dr. F. C. Harrison, (published elsewhere in this issue) the committee was re-appointed, under the chairmanship of R. Newton of the University of Alberta.

Luncheons, Banquets, etc.

Among those who spoke at special luncheons and banquets were Hon. J. E. Caron, Dr. J. H. Grisdale, Dr. James W. Robertson, Dr. F. C. Harrison, Rev. Father Leopold and the Presidents of the three Quebec Branches of the Society (Abel Raymond, A. Désilets and M. A. Jull).

Hon. J. E. Caron, in tracing the agricultural development of Quebec soundly refuted reports that the farming classes were "unhappy and oppressed." In the course of his address he issued a warning to the district agriculturists in Quebec, (agronomes) to the effect that they should take no part whatever in policies, either federal, provincial or municipal, but should confine their efforts and interests entirely to the agricultural advancement of the county in which they had been placed.

Dr. J. H. Grisdale, Deputy Minister of Agriculture for Canada, emphasized the growing need for men with special, or advanced training. He suggested the advisability of establishing, in Canada, one or more (not too many) institutions which could furnish post graduate training to qualified students. This, the speaker claimed, was of the greatest importance. The day of specialists was with us, and the demand for these highly trained workers must be met if the advancement of agriculture was to continue. Canadians should be trained in Canada if proper facilities could be provided.

Advanced Lectures

The August issue of *Scientific Agriculture* will publish, in either abstract or complete form, all of the lectures given at the Convention. These abstracts are now being prepared by the authors themselves but, owing to the short space of time available, could not be included in the present issue.

Reports of Local Branches

Reports of the thirteen local branches of the Society, presented at the Convention and now filed in the office of the General Secretary, aroused a great deal of enthusiasm. The reports indicate steady progress in every province, an increase in membership in nearly all cases, and a desire to advance the interests of the organization.

A number of these reports called attention to the importance of reducing the amount of the annual fee, but, with that single objection (which has now been removed) there was no suggestion or criticism made regarding the operating policies of the Society.

GEORGE BOUCHARD, M. P.,

Professor of Botany at the Agricultural College, Ste. Anne de la Pocatière, who was recently elected member for Kamouraska County, by acclamation.

Resolutions

The following resolutions were adopted by the Convention:

1. The Canadian Society of Technical Agriculturists desires to bring to the attention of the Civil Service Commission of Canada their view that the matter of the classification of technical agriculturists by the commission, be given their early reconsideration with a view to providing for agricultural technicians a classification comparable to that which has been recently provided for positions requiring equal academic and technical training, experience and responsibilities in the other scientific services of the Government.

Moved by Dean E. A. Howes, University of Alberta, Edmonton.

Seconded by J. G. Robertson, Live Stock Commissioner, Regina.

2. Whereas National Research Institutes have been established in almost every important agricultural and industrial country in the world, including such countries as Japan, Australia, New Zealand, Sweden, etc. and whereas the early organisation of such an institute is essential to the economic development of the Dominion;

Therefore be it resolved that the Canadian Society of Technical Agriculturists, in annual Convention assembled, places itself on record as favouring the establishment of such an institute.

Moved by Dr. F. C. Harrison, Principal of Macdonald College. Seconded by R. Summerby, Prof. of Field Husbandry, Macdonald College.

3. The Canadian Society of Technical Agriculturists desires to commend the policy and practice, on the part of the federal and provincial departments of agriculture, of employing in all technical positions competent men who have had finished training in technical agriculture, and sincerely trust that any departure from such principle and practice be guarded against carefully.

Moved by H. Barton, Prof. of Animal Husbandry, Macdonald College. Seconded by F. N. Savoie, Secretary of the Department of Agriculture, Quebec.

4. Resolved that the members of the Canadian Society of Technical Agriculturists are strongly in accord with the maintenance of a selective or restrictive advertising policy for their official organ, as well as of the present editorial policy of compromise.

Moved by P. A. Boving, Prof. of Field Husbandry, University of British Columbia. Seconded by R. C. Treherne, Entomological Branch, Ottawa.

5. Resolved that a committee of one or two members be appointed to obtain and embody in a report to the Committee on Educational Policies, the completest possible information concerning:

(a) The exact system of organization of agricultural colleges and schools in the Dominion.

(b) The exact system of organization by means of which agricultural education is carried on through any other bodies.

(c) The ascertainable influence of particular features of an organization on the functioning of the system of organization as a whole.

(d) Such other facts as may be necessary to elucidate the theory and practice of these systems of organization.

Moved by R. S. Kennedy, Montreal Star, Montreal. Seconded by F. L. Drayton, Botanical Division, Experimental Farm, Ottawa.

6. Resolved that the General Secretary be instructed to communicate the appreciation of the members assembled in Convention, to the following, for their valued assistance in contributing to the success of these meetings:

The Honourable the Minister of Agriculture for Canada;

The Honourable the Minister of Agriculture for Quebec;

The Principal of Macdonald College;

The Principal of the Oka Agricultural Institute;

The lecturers;

The Local Reception Committees;

The Press.

Book Reviews

The Mating and Breeding of Poultry, by H. M. Lamon and R. R. Slocum, Orange Judd Co., New York, $2.50, pp. XXIV + 341, figs. 97.

This book is a rather complete treatise on breeding poultry for all purposes but dealing particularly with the mating and breeding of standard-bred poultry for exhibition. There are three pages of definitions of common breeding terms followed by three chapters of the principles and practice of breeding.

The first chapter deals particularly with the general problem of heredity and leads up to an elementary consideration of Mendelism. The second chapter is on the practices of breeding and is of special value to all poultry raisers. It discusses inbreeding and line breeding and the different kinds of matings which poultry breeders use in the production of standard breeds and varieties. Chapter three deals with breeding for increased egg production. It discusses in a general way how high egg producing ability is supposed to be inherited and lays stress upon the importance of constitutional vigour. The method of conducting pedigree breeding work is fully explained and well illustrated and the same chapter also includes a general illustration of developing egg-laying strains. Chapters four to fifteen are descriptive chapters dealing in detail with the ideal type and colour qualifications of all breeds and varieties of poultry. Valuable suggestions are also made in regard to particular matings adopted to produce best results from the standard standpoint for each breed or variety, whenever a particular mating is necessary for that purpose. The last chapter in the book, chapter sixteen, gives many practical suggestions with reference to preparing fowls for the show. The entire book is well written and well illustrated.—M. A. J.

Turkey Raising, by H. M. Lamon and R. R. Slocum (Orange Judd Co., New York, $1.75.)

This is a treatise on the practical phases of turkey raising. The history of turkey raising is discussed and the desirable qualities of the different breeds and varieties are treated fully. Information is given in regard to mating birds to produce exhibition stock and suggestions are made as to how to ship and show birds. The balance of the book deals particularly with the common aspects of the turkey industry including the manner of handling the stock, incubation, brooding and rearing and there is a good chapter on marketing. The last chapter deals with insect pests, diseases and predatory animals. It is a very good book for all who are interested in turkey raising. —M. A. J.

REV. FATHER LEOPOLD
who entertained the Convention at the Oka Agricultural Institute on Dominion Day

Convention Annuelle des Agronomes Canadiens

La deuxième convention annuelle des Agronomes Canadiens a eu lieu au Collège Macdonald, du 26 au 30 juin. Cette Convention constituera certes une date importante dans l'histoire agricole du pays. Plus de deux cents membres venant de toutes les provinces du Dominion prirent part à cette Convention qui se composait de professeurs de techniciens et de praticiens agricoles.

Ce groupe d'hommes d'élite fit un excellent travail en cherchant une juste solution aux principaux problèmes agricoles qui se posent actuellement au pays.

L'on put se rendre compte une fois de plus, que l'harmonie et la bonne entente peuvent régner au sein d'une société composée de membres appartenant aux deux races quand ceux-ci tendent à un idéal commun. Tous ceux qui assistèrent à cette convention furent enchantés de la cordiale hospitalité et du précieux confort qu'ils reçurent au Collège Macdonald. Il ne pouvait se rencontrer d'endroit plus favorable aux assises d'une telle convention. Une courte promenade autour des multiples pavillons qui sont groupés à un endroit vraiment féérique était suffisante pour effacer toutes les traces de fatigue que l'on pouvait éprouver à suivre les nombreuses conférences qui furent données.

Discours

Monsieur L. S. Klinck, président de l'Université de la Colombie Anglaise à Vancouver adressa la parole, lundi soir, et parla de l'avenir de la Société des Agronomes Canadiens et il laissa entrevoir les heureux résultats qu'obtiendra cette société.

"Cette Convention, dit M. Klinck, produira d'excellents fruits en permettant l'échange des idées et la comparaison des expériences. Le contact d'hommes de formations diverses et d'opinions divergentes annule les effets de l'isolement forcé, augmente la somme de nos connaissances, permet de donner de nouvelles interprétations à des faits anciens et familiers..." "Il est temps, dit-il, de créer nos propres traditions scientifiques et d'avoir le sens de nos obligations. Nous devons chercher à créer de meilleures relations entre les membres de notre profession et ceux des autres professions, de resserrer les liens de notre industrie avec les autres professions, de resserrer les liens de notre industrie avec les autres industries connexes." M. Klinck dit que la Socitété des Agronomes devra s'efforcer, d'ici plusieurs années, de résoudre trois probièmes très importants: la politique agricole, l'éducation agricole et l'association des agriculteurs techniciens.

Il conclut en disant que l'agriculture canadienne a grandement besoin de s'inspirer d'un idéal intellectuel, parce que l'agriculture a pour but immédiat des préoccupations d'ordre politique et qu'elle doit sans cesse se retremper à des sources fécondes et d'ordre plus élevé.

Le Dr. J.-H. Grisdale, sous-ministre de l'agriculture, du Dominion, le principal orateur, au lunch de mercredi, présidé par le professeur J.-B. Reynolds, a souligné le fait que le Canada manque d'hommes suffisamment versés dans les hautes sciences agricoles, à tel point que le ministère fédéral de l'agriculture a dû récemment chercher un fonctionnaire compétent aux Etats-Unis et se demande où il pourra en découvrir un autre en Canada pour remplir une position importante. Il préconise en conséquence l'établissement de cours supplémentaires (post graduate courses) dans un de nos collèges agricoles afin de permettre aux bacheliers en agriculture de compléter leurs études et d'acquérir les connaissances techniques suffisantes pour répondre à tous les problèmes de la science agricole. Les collèges d'agriculture font sans doute un excellent travail, mais on ne peut s'attendre à ce qu'ils forment des savants dans l'espase des quelques années de cours régulier. Il s'ensuit que les gouvernement doivent envoyer aux Etats-Unis, chaque année, quelques-uns des élèves les plus brillants, sortis des collèges d'agriculture, afin de leur faire suivre des cours post-scolaires et il arrive assez souvent que ces élèves ne reviennent plus au Canada. Les collèges d'agriculture devraient faire en sorte d'élever le niveau de leur enseignement.

Le professeur W.-T. Jackman a renchéri sur le Dr. Grisdale en disant que beaucoup de collèges agricoles n'ont pas de professeurs réellement compétents pour enseigner l'économie rurale et pourtant cette science est d'une importance capitale pour les cultivateurs. Il fit quelques suggestions quant à l'enseignement de ses principes fondamentaux, savoir le coût du capital, les taux courants des intérêts, les prix des produits de la ferme, le crédit rural en rapport avec le

crédit commercial, etc. Seul un homme parfaitement versé dans ce genre de connaissances abstraites, peut les enseigner intelligemment.

Le professeur Jackman passe ensuite au système de "homesteads" établi en Canada et laisse planer un doute relativement à son efficacité au point de vue de la richesse nationale. Il se demande si l'utilisation des terres dans les provinces de l'ouest est bien un succès? Certaines fermes, dit-il, tombent entre les mains d'hommes qui n'en ont pas plus besoin que de deux femmes. Il arrive qu'ils les détiennent jusqu'à ce que la population se soit accrue et qu'ils les revendent à des prix élevés qu'ils ne méritent pas d'avoir.

Banquets

Mardi soir, le ministère de l'agriculture de Québec offrit un banquet à tous les congressistes. Le R. P. Léopold présida ce banquet et après avoir proposé la santé du roi, il donna la parole à l'Hon Ed. Caron, ministre de l'agriculture, qui adressa d'abord la parole en anglais et souhaita la bienvenue à tous les délégués des différentes provinces. Il se dit heureux de voir que cette Convention ait lieu au Collège Macdonald qui fait non seulement l'orgeuil de la province, mais aussi de tout le Canada. C'est un monument élevé à la mémoire de Sir William Macdonald qui eut l'excellente idée de consacrer quelques uns de ses millions au bénéfice de l'enseignement en général et de l'enseignement agricole en particulier. Parlant ensuite des écoles d'agriculture canadiennes-françaises, M. Caron dit qu'il en est aussi fier que du Collège Macdonald. Il offrit ensuite ses félicitations au président actuel de la Socitété des Agronomes Canadiens, M. J.-B. Reynolds, ainsi qu'au président sortant de charge, M. L. S. Klinck.

M. Caron adressa ensuite la parole en français et démontra, chiffre en main, ce que le département de l'agriculture fait pour l'agriculture et pour l'expansion de l'éducation agricole.

Voulant aborder une question assez épineuse, le Ministre de l'Agriculture commença par se défendre à maintes reprises de faire de politique en cette occasion.

"Il y a certaines personnes dans cette province qui s'évertuent à crier que le cultivateur est opprimé. Ces personnes disent que la classe agricole a été négligée par les divers gouvernements. Ces mêmes personnes cherchent à convaincre les agronomes de leurs doctrines afin d'en faire des chefs politiques et des partisans du parti fermier. Je me permettrai cependant, Messieurs les agronomes, de vous donner un conseil et de vous dire, ne vous mêlez pas des affaires politiques. Ne vous occupez pas plus des questions politiques provinciales ou fédérales que des affaires municipales, mais occupez-vous plutôt de remplir les devoirs de votre profession, qui sont d'enseigner au cultivateur les meilleures méthodes de production afin d'améliorer sa situation et de lui donner le rang qu'il doit occuper dans la société." Pour appuyer sa thèse, M. Caron donna des statistiques itéressantes et nous indiqua le nombre exact des moutons que le ministère de l'agriculture avait fait baigner par l'entremise des officiers de son département. Les centaines de mille piastres que cette seule opération ministérielle a déjà fait épargner aux cultivateurs de la province compensent généreusement les dépenses que nécessite le personnel agronomique. M. Caron parla ensuite de l'ordre du Mérite Agricole qui n'existe pas dans les autres provinces et il annoça que, dès cette année, cet ordre honorifique serait divisé en deux sections dont l'une comprendrait les cultivateurs agés et l'autre les jeunes cultivateurs de 18 ans qui recevront pour récompense un jeune animal enregistré ou un instrument aratoire. M. Caron conclut en disant que le cultiateur est réellement l'homme le plus heureux de la communauté et que de sa prospérité dépend dans une large mesure la prospérité de la nation.—Epidetète avait dit avant lui: "Ce qui trouble les hommes ce ne sont pas les choses elles-mêmes, mais les opinions qu'ils s'en font."

Le R. P. Léopold remercia l'Hon. Caron de la générosité dont le gouvernement avait fait preuve, en accordant un généreux don pour défrayer les frais de la Convention.

Les invités n'eurent pas le plaisir d'entendre l'Hon. Manning Doherty, ministre de l'Agriculture de l'Ontario, qui devait lui aussi adresser la parole à ce banquet.

Un banquet fut aussi offert par le Collège Macdonald, mercredi soir et il fut présidé par le Dr. F.-C. Harrison, principal du Collège Macdonald. L'honorable W.-R. Motherwell, ministre de l'agiculture, qui devait prononcer un discours s'est excusé par télégramme de ne pouvoir prendre part aux agapes, à cause d'une séance du conseil minis-

tériel à Ottawa, Sir Arthur Currie, principal de l'université McGill, n'a pu aussi assister au dîner, n'étant pas encore de retour de son voyage dans l'ouest. En leur absence, plusieurs délégués des différentes provinces adressèrent tour à tour la parole.

Conférences

Plusieurs conférenciers de renom nous entretinrent, chaque jour, sur des sujets très importants et très intéressants:

M. W.-T. Jackman, professeur d'économie politique de l'Université de Toronto, sût capter l'attention de ses auditeurs en traitant les sujets d'économie rurale, "L'équilibre harmonieux entre l'industrie rurale et urbaine," "Conditions de la permanence et de la stabilité de la papulation agricole". Dans cette dernière conférence, il s'appliqua particulièrement à résoudre l'équation suivante: les services qu'un homme rend à la nation sont égaux à la marge qui existe entre la production et la consommation de cet homme.

Dans sa dernière conférence intitulée: "Effets du capital emprunté" M. Jackman établit au moyen de chiffres que, toutes choses égales d'ailleurs, il y a très souvent avantage à emprunter de l'argent pour faire les améliorations nécessaires sur une ferme afin d'en augmenter le pouvoir de production, mais que tout repose sur l'habilité du cultivateur à utiliser ce capital.

M. A. Leitch. professeur au Collège de Gulph, traita aussi d'économie rurale." Il n'a a pas lieu, dit-il, de s'alarmer outre mesure de l'exode rural, car avec les instruments que le cultivateur possède aujourd'hui, il peut produire suffisamment pour nourrir un plus grand nombre de consommateurs qu'autrefois. C'est une erreur profonde de croire que la ferme est un endroit où l'on ne s'occupe que de faire croître les plantes. Le cultivateur doit résoudre une infinité d'autres problèmes qui sont intimement liés à son genre d'exploitation.

"Le grand problème agricole de l'heure, dit-il, c'est le problème de la vente des produits agricoles. Jusqu'ici on s'est surtout occupé d'améliorer les méthodes de production et l'on a peut-être trop négligé le problème de la vente. Il faut maintenant chercher à développer les coopératives d'achat et de vente ainsi que les coopératives de consommation."

Les autres conférenciers furent le Dr. L. J. Cole, professeur à l'Université du Wisconsin, le Dr. M. O. Malte, Botaniste en chef du Dominion, le professeur Stapledon, directeur de la Station Agrostologique d'Aberyswyth, le Dr. Bruce Macallum.

Résolutions

L'on adopta au cours de cette convention de nombreuses résolutions. Parmi les plus importantes, notons celle qui a pour objet l'établissement d'un Institut National de recherches en agriculture; l'endroit ou se tiendra la prochaine convention. Cette convention aura lieu à Saskatoon, Sask.

Le Congrès a chargé le conseil exécutif de s'adresser à la Commission du Service Civil, en vue d'obtenir un nouveau mode de classification en tant que sont concernés les techniciens agricoles, en tenant compte des connaissances, de l'expérience et des responsabilités de ceux-ci, comme on le fait pour les autres corps professionnels. Jusqu'ici la Commission du Service Civil a tenu à un niveau inférieur les techniciens agricoles quand on exige d'eux autant de compétence qu'on en requiert des autres classes professionnelles.

Titres honorifiques

Le professeur L.-S. Klinck, président de l'université de la Colombiè-Anglaise à Vancouver a été élu compagnon de la société. Il est le second à recevoir ce titre honorifique qui fut accordé en premier lieu au Dr. Charles Saunders, ancien céréaliste du Dominion, le découvreur du blé Marquis. Le gouverneur général du Canada a été nommé membre honoraire.

A Oka

Le samedi, le premier juillet, les délégués se sont rendus à Oka. Ils ont visité les principaux établissement de la ferme des Révérends Pères Trappistes. Le troupeau laitier, de la Trappe, l'un des meilleurs de la province de Québec, les a particulièrement intéressés.

Au cours du banquet offert par le Révérend Père Léopold, directeur de l'Institut Agricole, MM. L. S. Klinck, F. C. Harrison, J. B. Reynolds, H. M. Nagant, Abel Raymond et autres ont adressé la parole.

Ils dirent avec éloquence la vive satisfaction qu'ils éprouvaient de venir terminer cette convention dans une institution agricole canadienne-française et ils exprimèrent le voeu de voir s'établir un lien plus intime entre les institutions anglaises et françaises du pays.

De copieuses libations de l'excellent vin d'Oka neutralisèrent les émanations du fromage non moins célèbre et firent monter l'enthousiasme à un degré très aigu.

Le banquet se termina par des acclamations au nom de l'Institut d'Oka et de son directeur le R. P. Léopold. Les invités songèrent, non sans regret, regagner leurs foyers. Ils firent en passant une visite à la Ferme de Saint-Sulpice, une des plus belles du pays.

Nous exprimons, au nom de tous les membres de la branche de Québec de la Société des Agronomes Canadiens, nos plus sincères remerciements au Collège Macdonald, à l'institut Agricole d'Oka et au Gouvernement provincial ainsi qu'à tous ceux qui ont participé d'une façon quelconque au succès de cette Convention.

Industrie Laitiere dans Quebec

Les fourrages, facteur important et trop négligé.

Par J. ADELARD GODBOUT,
Ste-Anne-de-la-Pocatière, Qué.

On vante un peu partout, depuis quelque temps, les progrès réalisés en industrie laitière dans notre Province. Et je ne crois pas qu'on ait exagéré le beau travail accompli par nos cultivateurs dans cette branche de l'industrie agricole.

Depuis dix ans le rendement moyen de nos vaches laitières a été considérablement augmenté grâce au choix plus judicieux des reproducteurs, au contrôle mieux suivi de la production annuelle, et à l'alimentation enrichie par l'apport de plus de concentrés.

Les conditions d'hygiène dans lesquelles on place les animaux laitiers s'améliorent d'années en années; les étables sont mieux construites, plus éclairées, mieux ventilées et plus proprement tenues.

La campagne du lait propre et sain lancée par le Ministère de l'Agriculture, et si bien poussée par les Inspecteurs de beurreries et de fromageries a porté ses fruits; et les cultivateurs sont plus minutieux dans les soins donnés aux produits laitiers.

Mais il est un facteur de succès, essentiel à mon sens, auquel on ne semble pas donner toute l'attention qu'il mérite; c'est l'amélioration des fourrages destinés à l'alimentation de nos vaches laitières.

Le principle général déjà vieux et connu de nos pères que dans l'alimentation des animaux domestiques les aliments produits sur la ferme coûtent moins cher que ceux provenant du dehors, reste toujours juste d'application; et de nos jours encore les cultivateurs placés dans les conditions ordinaires trouveront leur profit à se passer le plus possible des aliments coûteux du commerce. Les concentrés que nous ne pouvons pas produire, en culture extensive, aussi avantageusement que nos voisins se classent, pour nous, dans la catégorie des aliments coûteux.

On a semblé depuis quelque temps ne pas tenir compte exactement de cet état de chose.

Quelques-uns, même de ceux qui sont chargés de guider les cultivateurs ont paru consentir à la fausse interprétation du conseil qu'il faut leur donner de soigner plus richement leurs animaux; et l'opinion est assez généralement répandue chez les practiciens que l'alimentation plus généreuse prônée par les agronomes consiste à introduire, à forte dose, les concentrés dans les rations.

Cette fausse interprétation de la doctrine que nous prêchons en commun peut conduire à l'un ou l'autre de deux résultats également désastreux: ou bien les cultivateurs trouveront les concentrés trop cher pour les introduire de façon appréciable dans la ration de leurs animaux,—et avec des fourrages qu'ordinairement ils récoltent, l'alimentation sera plutôt chétive; ou bien, pour compléter leurs fourrages de qualité secondaire, ils achèteront de grandes quantités de concentrés. Et je ne crois pas que pour la moyenne des cultivateurs cette pratique conduise à des résultats beaucoup plus considérables.

Les concentrés du commerce sont ordinairement trop coûteux pour pouvoir économiquement servir en fortes proportions comme matière brute dans la fabrication des produits laitiers. Près des villes, les laitiers peuvent encore trouver leur profit à les donner en assez grande abondance à leurs vaches, mais personne n'oubliera que la plupart des cultivateurs ne sont pas placés dans ces conditions.

Sur les fermes ordinaires les concentrés ne devraient être achetés que pour compléter et balancer la ration au point de vue des éléments nutritifs. Or avec les connaissances qu'ont la plupart de nos fermiers en alimentation, il leur est très difficile, pour ne pas dire impossible, de balancer convenablement une ration avec les fourrages hydrocarbonés

qu'ils produisent et les concentrés que leur offre le commerce; tandis que des fourrages de trèfle et de luzerne de qualité leur fourniraient de suite une ration presque complète et facile à balancer par l'apport d'un peu de concentrés.

Le premier pas à faire vers l'amélioration dans le nourrissement de nos animaux laitiers doit donc consister à rendre meilleurs les pâturages qu'on leur destine et les plantes fourragères engrangées pour leur hivernement.

J'estime qu'une campagne de "l'amélioration des fourrages" lancée par les agronomes et poussée avec l'énergie, le tact et le savoir dont ils ont oujours fait preuve, porterait des fruits on ne peut plus bienfaisants.

Il faudrait d'abord amener les cultivateurs à semer plus de graines de plantes fourragères, à semer de meilleures graines et à faire des mélanges plus convenables.

Ils ne sont pas très rares les gens qui se contentent encore d'un "engrainage" de 3 à 4 livres à l'arpent.

D'autre part, on sème du mil, un peu de trèfle et pas autre chose. Combien de plantes ne pourrait-on pas ajouter, qui ont autant de valeur alimentaire que le mil, sont moins exigeantes et vont mieux en mélange avec le trèfle? La dactyle par exemple et le *ray-grass* épargneraient à nos gens l'embarras de la situation en face de laquelle ils se trouvent tous les ans: dans leur champ quand le trèfle est prêt à faucher le mil n'a pas fini sa pousse et s'ils attendent que le mil soit à point ils le récolteront avec de la paille de trèfle.

Beaucoup de plantes encore à peu près inconnues à notre région pourraient être introduites et semées en mélanges pour se compléter l'une l'autre. Il n'y a pas beaucoup de terres, en effet, dont on puisse dire que, telle année, elles pousseront mieux le mil, le dactyle, le *ray-grass* ou les pâturins. En confiant à chaque sorte de sol sur la ferme un mélange de graines qui lui soit approprié nos cultivateurs auront chance de voir au moins l'une des plantes semées fournir une récolte passable que complèteront les pousses plus ou moins abondantes des autres plantes.

Parmi les plantes que nous devrions nous employer à répandre de plus en plus le trèfle et la luzerne ont des avantages sur lesquels on ne peut trop appuyer.

Chacun connaît leurs effets sur les sols; on sait que, d'autre part, ils peuvent balancer une ration au point de vue de la matière azotée; on pense moins à ce rôle non moins important qu'ils peuvent remplir: minéraliser nos animaux.

Pour améliorer nos fourrages il est nécessaire mais il ne suffit pas de semer de bonnes plantes en mélanges convenable; il faut encore les confier à un sol bien préparé et préalablement pourvu des éléments nécessaires à une pousse vigoureuse; puis il faut faucher à temps et engranger convenablement.

Une bonne distribution des fourrages, d'après leur composition, aux divers animaux de la ferme est encore nécessaire pour lui faire donner leur maximum de rendement.

Je ne voudrais pas conclure sans dire un mot des pâtuarges que très souvent on néglige.

Si nous voulons être en droit de nous attendre à ce que nos pâturages soient autre chose que des enclos où les animaux prennent de l'exercice, il est sûr qu'il nous faut consentir à y semer des plantes convenables. Cependant combien peu de cultivateurs savent faire un bon mélange de graines pour pâturages!

C'est à l'agronome de leur faire connaître et apprécier mieux le trèfle blanc, les pâturins, les frétuques, la crételle, etc.

Il faut mettre fin encore à cette pratique courante de ne laisser en pâturage que les prairies complètement denudées.

Je me permets de soumettre ces quelques suggestions aux agronomes espérant qu'elles pourront n'être pas inutiles au succès de notre industrie laitière.

Pour ma part, je crois l'avenir de notre agriculture dans l'amélioration de nos plantes fourragères. Nous avons crié aux cultivateurs la nécessité des meilleurs reproducteurs, de plus de générosité dans l'alimentation, etc. Prenons garde que la balle ne nous revienne faute d'avoir atteint le juste but; et que les gens trouvent coûteux à garder et peut rémunérateurs les animaux améliorés auxquels ils ont compris qu'on leur recommandait de donner beaucoup de concentrés.

Maintenant que le mouvement d'amélioration est lancé, c'est à nous, agronomes, de le diriger pour qu'il n'aille pas, mal conduit, à un échec dont on nous tiendrait responsables.

Nos Connaissances Actuelles sur le Lait

Par M. LOUIS BOURGOIN
Ecole Polytechnique, Montréal

(Suite du numero de juin.)

Il faut signaler que le lait contient en solution des gaz: de l'oxygène, de l'azote et de l'acide carbonique, ce dernier étant le plus abondant et le plus apparent pendant la mulsion où il provoque la formation de la mousse. Le volume occupé par ces gaz est au maximum de 8,6cc%; nous ignorons leur rôle, ils ne peuvent provenir que du sang.

Bien que certaines substances comme les diastases se trouvent dans le lait associées aux globules gras, le nom de ferments solubles qu'on leur donne quelquefois, la présence de quelques unes en solution et enfin, la commodité de l'exposé sont autant de raisons pour que nous parlions ici de ces substances connues seulement par leur effets.

Des diastases existent dans le lait en dehors de celles produites par les bactéries qui composent la flore habituelle de ce liquide. On peut en distinguer quatre classes.

1) les hydrolases qui dédoublent la molécule d'un corps en fixant une molécule d'eau. Une des premières isolées, appelée bien improprement galactase, mieux désignée sous le nom de protéase, agit sur les albuminoïdes poussant la décomposition de l'azote jusqu'à la formation d'ammoniaque. Une amylase, ferment transformant l'amidon en sucre, a été trouvée dans le lait de femme et de cheinne, pas dans le lait de vache. Une monobutyrinase, pouvant agir sur l'éther monobutyrique de la glycérine pour le saponifier, est identifiée.

2) Les diastases oxydantes qui ont été rencontrées dans le lait sont des peroxydases. Elles empruntent l'oxygène dont elles ont besoin pour oxyder les corps à d'autres qui en contiennent, comme l'eau oxygénée. Le lait de vache, contrairement au lait de femme et d'ânesse, en renferme beaucoup.

3) Le lait détient de petites quantités de diastases réductrices dont la fonction est en quelque sorte inverse des précédentes, elles introduisent de l'hydrogène dans les molécules.

4) Enfin une talase, diastase pouvant décomposer l'eau oxygénée en eau et oxygène, est présente dans le lait.

Ces substances, dont l'identification est délicate, se rencontrent à peu près dans tous les produits organiques en plus ou moins grande quantité. Nous ne savons pour ainsi dire rien de leur origine encore moins de leur composition. Elles son sécrétées par les microbes, elles semblent être un résultat de l'activité vitale et, par d'autres côtés, lui être nécessaire puisque la plupart des réactions d'assimilation et de désassimilation sont sous l'empire des diastases. De petites quantités sont indispensables pour provoquer la transformation de masses relativement considérables; ce sont des catalyseurs n'intervenant dans les réactions que par leur présence. Très sensibles, elles sont irrémédiablement détruites par la chaleur.

Ces diastases sont apportées dans le lait par le sang, particulièrement les leucocytes que nous trouvons en grande quantité, ayant traversé eux aussi les cellules épithéliales des

CENDRES DU LAIT DE VACHES,

(Différents auteurs)

Chlorure de sodium	4.74	16.23	4.89	4.43%
Chlorure de potassium	14.18	9.49	29.38	23.86
Potasse	23.46	23.77	29.38	5.86
Soude	6.96	23.77	8.57	5.86
Chaux	17.34	17.31	25.51	24.25
Magnésie	2.20	1.90	3.87	3.78
Oxyde de fer	0.47	0.33	3.87	3.78
Acide phosphorique	28.04	29.13	26.32	25.13
Phosphate de fer	28.04	29.13	1.42	1.26
Acide sulfurique	0.05	1.15	1.42	1.26
Acide carbonique	2.06	1.15	1.42	1.26
Silice	0.06	0.09	1.42	1.26

(Le lait Monvoisin)

acinis glandulaires, mettant dans le lait les mêmes éléments qu'ils véhiculent dans l'organisme par les vaisseaux.

Tels sont les corps en solution. Ce ne sont pas les plus caractéristiques du lait. Voyons maintenant les éléments en suspension. ,

b) Eléments en suspension: gras

La matière grasse que contient le lait est insoluble dans l'eau et dans le lait tel qu'il est constitué. Cette matière qui, au point de vue chimique, est formée d'un mélange de glycérides saturés par des acides gras (butycaprique — etc.) renferme aussi de 0,5 à 1% de matière insaponifiable qui récèle des rique-palmitique — oléique — stéarique — cholestérines, corps à fonction alcool caractérisques des graisses animales. Les diastases ont une action importante sur les glycérides qui aboutit à la mise en liberté de composés odorants produisant le rancissement.

Les graisses sont en émulsion dans le lait. C'est-à-dire sous la forme de petites sphères d'un diamètre variable et chez le même individu et d'un individu à l'autre et d'une race à l'autre; il varie de 1.5 à 10 mu, cette dimension ayant une importance pratique pour la séparation de la crème du lait.

On a longtemps cru que chaque globule gras était entouré d'une membrane, puis cette théorie a fait place à celle de l'existence autour du globule d'une enveloppe de matière azotée fixée au globule par simple attraction moléculaire. Cette muqueuse, qu'on ne trouve pas apparente dans l'examen histologique du globule gras en formation dans la cellule mammaire, ne se formerait qu'après la traite. On a aussi émis l'opinion que ce sont les lécithines, corps dont nous reparlerons et dont les graisses sont riches, qui concourreraient à la formation de cette couche particulière protégeant l'intégrité du globule graisseux et dont l'existence serait surtout révélée par la difficulté de solubilisation de la matière grasse du lait dans l'éther pur.

Ce que nous savons des lois de la capillarité suffit cependant à expliquer la forme sphérique du globule de graisse, son maintien, son élasticité, son ascension au sein du liquide au repos et les phénomènes particuliers comme le barattage, l'homogénéisation, la disparition de l'état d'émulsion dès qu'on modifie trop la tension superficielle du milieu par des moyens appropriés.

Il convient de parler ici d'un corps azoté d'importance considérable qu'on trouve associté à la graisse du lait; la ou mieux *les* lécithines. Ce sont des combinaisons d'acides gras (oléique-palmitique etc—) avec l'acide phosphoglycérinique et la choline. Ces substances, riches en phosphore, sont classées dans les lipoides ainsi que la cholestérine, qui a été identifié dans le lait parce que ces matières se comportent d'une façon analogue aux graisses et qu'on les sépare difficilement de celles-ci. Les lécithines suivent les graisses dans l'écrémage du lait, elles ont des vertus marquées pour notre nutrition, surtout dans les premières périodes de la vie, on les rencontre en grande abondance dans le lait de femme un peu moins dans celui de vache. Elles ont une structure tellement délicate qu'elles ne résistent pas à la chaleur.

Depuis plus de soixante ans les hypothèses et les expériences pour expliquer la formation des graisses du lait se sont succédées sans qu'aucune soit, à vrai dire, satisfaisante. Il ne paraît pas douteux cependant que la matière grasse du lait provienne des aliments; mais ce n'est pas par simple passage de la graisse alimentaire dans le liquide sécrété par les glandes mammaires. A preuve, c'est que la femme qui ingère à peu près 100 grs de matières grasses dans sa ration n'en donne que 40 dans son lait alors que la vache pour 400 grs ingérés dans une ration riche en tourteaux fournit par son lait environ 700 grs de graisses.

Tout ce que nous pouvons dire aujourd'hui, c'est que, par un mécanisme inconnu, la glande mammaire intervient pour emprunter au sang ses éléments ternaires (hydrates de carbonne) qu'elle transforme en molécules grasses ayant un caractère différent des graisses des tissus, qui pourtant ont la même origine, révélant ainsi la spécialisation qui est propre à la cellule qui la compose.[8]

Nous pouvons placer ici dans les constituants du lait ces substances dont l'existence s'est révélée à nous tout dernièrement et dont nous ignorons absolument la composition: les vitamines. Certaines sont solubles dans les graisses, c'est pourquoi on peut les allier aux éléments en suspension puisque la plus grande partie pour ce qui est du lait serait en solution dans l'élément gras.

Comme pour les diastases, dont quelquesunes trouveraient leur place ici, nous som-

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[8] Les graisses du lait se différencient des graisses des tissus par leur teneur élevée en glycérides et acides gras volatils.

mes d'une ignorance complète sur la nature chimique des vitamines et nous ne savons pas quelle quantité est présente dans le lait. Seuls les phénomènes de nutrition, chez les individus nourris avec des laits privés par des moyens artificiels de leurs vitamines, nous renseignent sur le rôle capital que jouent ces substances pour notre croissance et le maintien de notre équilibre vital. Elles semblent aussi, comme leur proches parentes lesdiastases, être un produit de la vie cellulaire végétale, dont l'action est sensible à l'état de traces. Cela expliquerait qu'elles soient si longtemps restées inconnues.[9]

c) Eléments colloidaux

Passons maintenant à l'examen des derniers constituants du lait: les éléments en pseudo-solution ou colloïdaux.

Depuis une vingtaine d'années nous avons acquis des notions un peu précises sur un état particulier de la matière; l'état colloïdal. Nos connaissances sont d'ailleurs minces, mais la physico-chimie qui nous les donne est pleine de promesses et les progrès de la chimie biologique commé de la biologie lui semblent bien subordonnés.

Les colloïdes sont des substances qui ne peuvent passer à travers certaines membranes; ils donnent dans les liquides des solutions imparfaites, discontinues. Un instrument, l'ultra-microscope, permet de voir que ces pseudo-solutions son formées de particules extrêmement petites en mouvement incessants et désordonnés qu'on nomme *micelle*. La micelle n'est pas un élément simple, on a pu constater qu'elle se divisait comme une molécule ordinaire, et les études des phénomènes de conductibilité électrique, de coagulation, nous font dire que la micelle est ionisée; qu'un ion, le *granule* est plus gros que ceux qui l'accompagnent et que tous ces éléments portent une charge électrique.[10]

La caséïne, matière azotée principale du lait, est en solution colloïdale dans le sérum formé par l'eau et les parties solubles dont nous avons parlé. A l'ultra microscope on constate l'existence d'éléments extrêmement petits les lactonies qui ne sont autre chose que la caséïne à l'état de poussière.

La caséïne appartient au groupe chimique très mal connu des paranucléoprotéides. Elle est insoluble dans l'eau, dans l'alcool, l'éther et les solvants ordinaires; un peu soluble dans l'acide acétique en excès, elle est plus soluble dans l'eau de chaux et les alcalins. Elle présente le phénomène curieux de rendre soluble le phosphate de chaux alors que celui-ci, par une action réciproque, assure sa solubilité. Elle ne coagule pas à la chaleur comme les albumines, mais elle présente sous l'action de diverses causes le phénomène du caillage qui est une sorte de coagulation.

Sous l'action de diastases, tout spécialement la pepsine, la présure qui serait très répandue dans la nature, de sucs végétaux, de certains corps chimiques sous certaines conditions, la caséïne coagule. Le lait devient gélatineux, il se forme un caillot qui finit par se rétracter en exsudant un liquide, le sérum. Ce phénomène qui est des plus importants tant au point de vue alimentaire qu'industriel a donné lieu à de nombreuses études, il est soumis à l'influence d'un grand nombre de facteurs et nous en sommes encore malheureusement à échafauder des théories physiques ou chimiques sur son mécanisme.[11]

Nous ne savons rien sur le mode de formation de la caséïne. Un fait à noter est que son taux augmente dans le lait dans les premiers jours de la sécrétion alors que celui des albumines diminue. Classée comme nucléoprotéïne, on pense que la caséïne doit avoir pour origine le noyau des cellules glandulaires qui se désagrègent pour passer dans le lait. Le phosphate de chaux qui, nous l'avons vu, intervient pour solubiliser la caséïne ne peut pas manquer de se rencontrer aussi sous la forme celloïdale car il s'unit volontiers physiquement à la caséïne.

Telles sont les connaissances que nous possédons sur les éléments qui composent le lait normal et aseptique. Avant d'aborder l'étude de la seconde partie de ce travail, nous ne pouvons omettre de parler des éléments organisés du lait: des leucocytes et des bactéries.

(*à suivre.*)

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9 C'est un médecin belge le Dr E. Wildiers qui aurait été le premier à signaler l'existence de ces substances indispensables à la vie vers 1901. Ces substances dont il donne les caractères généraux correspondant aux vitamines, étaient dénommées par lui "Bios" et provenaient des levures. C'est un fait connu depuis longtemps chez les chimistes de brasserie que les levures se développent mal dans les milieux minéraux purs. Les travaux de Wildiers furent publiés en 1901 dans "La Cellule" sous titre: *Nouvelles substances indispensables au développement de la levure.* Voir pour historique Dr. H. Allaeys: *Vitamines et Stomatologie.* (*Revue Belge de Stomatologie,*) Nos 9 et 10 1920.

10 Jacques Duclaus: *Les Colloides* (Paris 1920.)

11 J. Effront: *Les catalyseurs biochimiques:* (Bruxelles et Paris, 1914).

The Environment for Research *

L. S. KLINCK, President of the University of British Columbia, Vancouver, B. C.

Last summer, while playing truant from the sessions of the Congress of the Universities of the British Empire, it was my good fortune to meet, in his private laboratory, a research scientist who is known throughout the English-speaking world. He had not attended a single session of the Congress nor did he intend to do so. In reply to a question from him as to what phase of University work was under discussion that afternoon, I replied, "The Universities and Research". "Talk, talk and then more talk", said he caustically. "To certain types of minds, the discussion of research is so fascinating that they cannot refrain from talking and writing about it even though these activities preclude the doing of any original investigation on their part". "Yes", he continued, "research is fascinating to the research man, but sometimes I think it must be even more alluring to those who are responsible for giving the subject a place on the programs of Congresses and conventions."

This eminent authority then remarked that he had spent the greater part of the day in unpacking new equipment. To me it seemed that the services of a janitor or of a laboratory assistant might have been employed more economically at such a task; while the appearance of the laboratory itself constituted an even more convincing reason for engaging less skilled labour for this purpose. Presumably the Master was so interested in seeing the new equipment that he considered his day had been well spent. All this, by the way, was an unconscious and most illuminating commentary on the wisdom, or lack of wisdom, of giving the subject "The Universities and Research" a place on the program of the Congress.

With us, in British Columbia, the subject is unquestionably a timely one; and there are, from an administrative point of view at least, reasons why I should have been requested to address you on "The Environment for Research". I shall not undertake a comprehensive treatment of the subject but shall approach it from the angle of those engaged in agricultural teaching and investigation. Within this restricted field, I shall endeavor to show that research on the part of members of our agricultural staffs is essential to good lecture and laboratory instruction, and no less necessary to the training of graduates if they are to have the right attitude towards this fundamental question.

When I make the statement that the quality of the instructional work is very directly affected by the amount and character of the researches conducted, I am not unmindful of the heavy burden of lecturing and administration which the staff have cheerfully assumed. Neither have I forgotten that practically all our available resources are required for student laboratory and other like equipment; nor have I lost sight of the fact that work of such uncertain and so expensive a nature, as is research, will never be popular with the general public. But after making due allowance for these conditions, we cannot overlook the fact that experimentation and research are absolutely essential to effective teaching and that for this, if for no other reason, it must be encouraged. Research is a form of university work which cannot be overlooked or neglected without fatal consequences.

While a high standard of achievement in research should be set, it will, in the nature of things, be impossible for all to attain it; and while it is desirable that investigations be original, it is not necessary that all be so. For the average instructor who is carrying on a piece of investigation, one thing is more important than striking originality, more important even than brilliant achievement, and that is his own attitude of mind towards the fundamental question of research.

The personal attitude towards this subject is important in all Universities but it is particularly so in our own because we are more isolated than are the workers in most other institutions. Moreover, nearly all the members of the teaching staff are young; and unless satisfactory arrange-

* An address delivered before the Provincial Convention of the C. S. T. A., Vancouver B. C. April 4 and 5, 1922.

ments can be made to allow them to pursue their investigations, either at home or in other universities, the status of the institution will soon be adversely affected. Unless such a policy is adopted there will be, before many years, a predominance of men past middle life, who, if they had been given a reasonable opportunity, some little encouragement and some well deserved recognition, would have remained, not in the ranks of men who have arrived, but in the ranks of those who continue to grow.

Recognition of these facts, coupled with a desire to encourage scholarship, has led the Board of Governors to adopt a more liberal policy with respect to members of the staff who may wish to proceed to a higher degree or who may desire some financial assistance to attend scientific or departmental meetings. More recently the policy of making some contribution towards defraying the travelling expenses of members of the staff who make a systematic study of conditions directly related to their subject, whether at home or abroad, has been decided upon. In the latter instances the amounts are relatively small and should be regarded more in the nature fo an evidence of friendly interest and of good-will than as a factor of sufficient monetary importance to determine the instructor's course of action.

These provisions are, I trust, but a beginning. Modest as they are, they are sure to fluctuate; but the goal towards which we should continue to strive is the making of provision for a measure of research in every department of the University. Such a policy, when made effective, would encourage original investigation, would give fitting recognition to the investigator, would create the necessary environment and atmosphere, would prove an admirable training ground for young men and women in research, in a word, would be of inestimable value to the students, to the professors and to the University as a whole.

If any measure of success is to be attained in promoting research, there must be not only good laboratory facilities but good library facilities as well. Moreover, in agriculture, it is essential that the investigators have "outside laboratories" in which to conduct their researches under field conditions.

It is not too early for the University of British Columbia to consider the possibility of establishing a number of Research Professorships. The incumbent of such a position should not be required to give more than three or four lectures per week but should be free to give practically his whole time to his researches.

In this connection the policy of the Faculty of Agriculture in the University of Alberta is one which is worthy of careful consideration, and we shall follow with more than usual interest, the results of the progressive policy adopted there.

The need for the establishing of Research Professorships in our Universities, without regard to Faculties, is becoming more generally recognized. In a recent publication of the Honorary Advisory Council for Scientific and Industrial Research entitled "A Plan for the Development of Industrial Research in Canada", Dr. Ruttan says: "As a result of a careful survey of the researches carried on in Canada and of the scientific organization of the industries, we were reluctantly compelled to recognize the fact that scientific research in Canada is practically confined to the laboratories of two or three of our Universities and one or two departments of the Government".

In order to correct this condition and to retain in Canada those of our graduates who show capacity for research, the Honorary Advisory Council for Scientific and Industrial Research has, through its system of Bursaries, Studentships and Fellowships done much to encourage young men and women who possess the necessary aptitude and training, combined with the "requisite initiative and independence of action in presenting original investigation", to remain in this country and devote their talents to the building up of the land of their birth. These grants are sufficiently generous to enable the recipients to continue their investigations without interruption at the conclusion of their post graduate courses. This farseeing policy cannot fail to strengthen the corps of research workers in this country.

In this connection a very important and vital question arises, namely, where can such special training be obtained? A limited number of research workers can be accommodated in Canadian Universities; a larger number may soon be given the

necessary facilities in the Central Research Institute at Ottawa; but the majority will, for many years at least, have to go to European or American Universities. Fortunately this is not an unmixed evil, as it should bring home to Canadian institutions of higher learning not only the imperative necessity of recognizing the need for the expansion and enrichment of their curricula but also the urgency of educating the public to a realization of the fact that such facilities must be provided for without undue delay.

Obviously it is beyond the province of any university, or of any group of universities in this country, to assume the full or even the major part of the responsibility for the establishment of the necessary laboratories and for the maintenance of a highly qualified staff. The major part of this work should come under a Federal organization such as the Central Research Institute. Even admitting this general truth, the Universities, nevertheless, should make such provision for their staff that the spirit of research may be fostered in every department and such an atmosphere created as may encourage young men and women to qualify themselves for this most useful public service.

"The kernel of this problem", as it relates to Canada, said Dr. A. B. Macallum recently, "is the fact that not one of our leading Universities is staffed and equipped in science to compare with any one of the ten leading Amercian Universities."

In speaking on this question at the Oxford Congress last summer, R. W. Lee, Rhodes Professor of Roman-Dutch Law, University of Oxford, said: "The Dominions are looking to the Universities of the old country to do for them what they cannot at present do for themselves — to supply them with ample and varied opportunities for post graduate work .... Never in the history of University education, was there such an opportunity as still offers, but will not much longer offer, itself to the Universities of the Old Country. Are we here, in Oxford, alive to it? Have we even now learnt to take a large and imperial view of education. If the answer must be in the negative, I conjure the representatives of the Dominions attending this Conference to tell us with the utmost frankness what they want, and what (if the case be so), they do not get ...... Let us make the most of an unexampled opportunity."

In concluding my address, permit me to quote a statement which I made before the Vancouver Institute when speaking on "Gleanings from the Congress of the Universities of the Empire". On that occasion, I said: "For reasons which are patent to all, I have not attempted to deal with one very important subject except indirectly and by means of one or two incidental referenees. I refer to research — research scientific, historical and humanistic. I cannot refrain from stating, however, that during the past five years there has been a complete change of attitude on the part of the Universities of the Mother Country towards providing post graduate facilities for students from the overseas Dominions. If the two Congresses of the Universities of the Empire have accomplished no other useful purpose, they will still, in my considered judgment, have abundantly justified their existence".

APPLICATIONS FOR MEMBERSHIP

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E. G. Booth (Saskatchewan, 1921, B.S.A.) Dept. of Agriculture, Regina, Sask.

R. L. Conklin (Cornell, D.V.M.) Macdonald College, P. Q.

C. E. Lampman (Wisconsin, 1921, B.S.A.) Macdonald College, P. Q.

H. McPhail (Manitoba, 1915, 1921, B.A., B.S.A.) Hazenmore, Sask.

J. M. Robinson (McGill, 1912, B.S.A.) Salmon Arm. B. C.

J. M. Smith (Edinburgh, 1919 B. Sc.) Dept. of Agriculture, Regina, Sask.

E. D. McGreer (McGill, 1922, B.S.A.) Live Stock Branch, Ottawa, Ont.

H. F. Williamson (McGill, 1915, B.S.A.) Farmingdale, L. I., U.S.A.

G. D. Matthews (McGill, 1921, B.S.A.) S.S.B. Quebec, P. Q.

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John Dougall, Agricultural Agent, C.P.R. Montreal.

W. H. McGregor, Lot 16, P. E. I.

S. J. Moore, Truro, N.S.

A. E. Wilson, Seed Grain Purchasing Commission, Regina, Sask.

Rural Economics

Abstracts of four lectures delivered by W. T. Jackman, University of Toronto, at the C.S.T.A. Convention.

I.—What is Rural Economics?

Until very recently most of the agricultural colleges devoted their entire time to the subjects pertaining to production, with the object of improving the quality or increasing the quantity of the things produced. But in recent years it has been noted that no matter how much greater the farmer's production may be nor to what extent he devotes himself to the development of improved breeds of live stock or better grains, his returns from his enterprise do not keep pace with these improvements of agricultural technique and he has been led to inquire into the reasons for this fact and to some means of obtaining a more adequate return. This has brought him into contact with the economics of agriculture. The farmer has found that he has to deal with a commercial mechanism, controlled by economic principles and acting according to economic laws. He must buy from and sell through this mechanism. He has become a part of it whether he will or not. He is an integral element in this commercial mechanism in which he is caught, and, finding that he must do business through this medium, he has been compelled to turn his attention to a study of the forces which operate within this trading and industrial organism, that is, to the economics of business. He recognizes that agriculture must be run upon business principles if it is to be successful, and, consequently, he is keenly interested in those subjects of study which we may group under the heading of rural economics.

What is rural economics? Briefly, we may say that it is general economic principles applied to the problems of agriculture. To use an analogy, we may note that chemistry is divided into many divisions, such as agricultural chemistry, industrial chemistry, physical chemistry, electro chemistry, etc., each of which is the application of the general knowledge of chemistry to the special field of which it treats. In each of these subdivisions of this science the results attained frequently aid in clarifying the principles or facts upon which general chemistry is built; and not infrequently the knowledge gained in a special field comes back to enrich the storehouse of knowledge of the general science from which it proceeded. In the language of Longfellow: "That which the fountain sends forth returns again to the fountain." So, in the case of agricultural economics, we have an offshoot from the science of economics. Its inception is in general economic principles and it is dependent upon them. The results secured from the study of agricultural economics have served to emphasize and occasionally correct, while at the same time making more vital and concrete the study of general economics. It is evident, then, that while the pursuit of the field of rural economics proceeds or sets out from general economic principles the latter must also be the goal of return; the truth in rural economics must be tested by the general economic principles.

Moreover, there has arisen to-day the demand for a science which will give counsel concerning the practical conduct of present farm undertakings. Success in agriculture, as in any other business, is measured by the income obtained, not by the physical amount of product derived from merely technological processes. It is one thing to increase the amount or quality of the product; it is another thing to secure increased income from these sources. Plant breeding, animal husbandry, horticulture, etc., by increasing the amount or character of the physical product tend to increase the farmer's income; but there are so many economic factors which act to nullify this that unless the farmer can make economic principles his guide his larger productivity may be rewarded by an income smaller than before. But a thorough knowledge of economics is just as valuable to him as is a knowledge of the plant and animal life with which he has to deal; and unless he acts upon economic principles when in contact with a business organization governed by economic laws, he cannot expect to be able to secure the highest rewards of his enterprise.

The emergence of these economic phases of agriculture has been very recent. When good land near the markets was abundant and produced large crops without the necessity of putting anything back into the land there was very little thought of economizing the land. But with the fertility of the soil becoming depleted and with the more complex and highly organized groups between the producer and the consumer, it has become necessary for the farmer to give much thought as to how he can meet this trading organization in all its parts and not be overwhelmed by it.

Professional economists have not concerned themselves very much with the problems of agricultural economics. The latter has been left pretty largely to those in the agricultural colleges and in these very few men have the ability or knowledge that is requisite to deal with them. Men who are trained in animal husbandry, horticulture, agronomy and kindred subjects of the agricultural college course lack entirely the preparation for undertaking the consideration of economic problems. We are not decrying the work of the agricultural colleges; they have done a great work in raising the status of agricultural production and putting it upon a scientific basis. But after this has been done there should then be, as the capstone of their training, a thorough study of the economics of agriculture, so as to give those engaged in this pursuit the knowledge of the great realm of business which is so essential to their success. Because of this lack of specialized training, the graduates of the agricultural college, and frequently also their instructors, have but a fragmentary and superficial view of the economic questions with which agriculture is related.

In dealing with soils the colleges have made a knowledge of chemistry an indispensable requisite; in order to be a well trained veterinarian or animal husbandman a knowledge of biology, anatomy and chemistry is necessary. It is strange that while these subjects are carried on by scientific methods, it is yet thought by some that the economic problems — which are the great problems to-day — can be handled by purely empirical methods. For instance, we have heard rural credits discussed at times as if the cost of the accumulation of capital or even the productivity of capital did not need to be considered in connection with this problem. Too often farm prices have been considered and explained in terms of the activities of the middlemen, who were regarded as mere toll-takers without any productive function. Not infrequently, too, cooperation has been put forth as the panacea for all ills, under all circumstances, and with all people, without taking into consideration the fact that different peoples have widely varying tendencies toward and capacities for cooperation.

Again, among some of the agricultural leaders, including not a few of those who are instructed in farm management at the agricultural colleges, there has been the tendency to regard economics as nothing more than common sense. In reality, it is common sense, but in this case, as in so many others where common sense is invoked, that sense is the rarest of all the senses. Economics is common sense, but it must be enlightened and instructed common sense. It takes more than the ordinary common sense to solve the intricacies of economic problems and among the latter none are more intricate than those pertaining to agriculture. There are many business men who fail to grasp the meaning and the application of economic principles and even among students in the universities there are not a few who are unable to comprehend the significance of economic phenomena. One might as well try to teach agronomy without chemistry or animal husbandry without biology, as to master agricultural economics without a knowledge of the field of general economics.

Without in any degree attempting to disparage the agricultural colleges — which would be far from our purpose—it may be said that most of them offer no adequate survey of the science of economics. In recent years the curriculum of many of the colleges has been augmented by the inclusion of what is called economics; but upon looking over the outline of such a course it is found to be largely a mixture of subjects connected with government, sociology and civics, intended to give the students a more intelligent interest in the world in which they are to live. Occasionally a course is given upon agricultural economics, but when we examine the contents of such a course we usually find it to consist of a general outline of two or three separate subjects— usually cooperation, marketing and rural credits — which must be merely descriptive

treatments for the students have no preparation for anything else, since they have had no training in general economic principles. It sometimes turns out that the instructor has had no such training. To study economics in this way is to proceed from the unknown, through the unintelligible, to the incomprehensible.

A younger group of so-called "agricultural economists" has been developing in the last few years, deeply concerned, as many of them are, in the economic aspects of agriculture. In most cases their viewpoint is that of the agricultural colleges, namely, to make the farmers more efficient in production through extending the farmers' control over the market in such a way as to increase their income returns. It is highly desirable that agriculture should be successful,but agricultural economics of this kind, intended to make the farmer nothing more than a money-getter, still leaves him unsatisfied as to his knowledge of the world in which he lives. He may be just as much out of harmony with his environment as a result of this little knowledge of economics as he was formerly without any knowledge of economics. The agricultural economics that will be of permanent value to the farmer and to the student of agriculture must be built upon the fundamental principles of the science unfettered by any preconceptions.

In conclusion, I may be permitted to set down some of the great problems of agricultural economics which are awaiting investigation by those who have a full and comprehensive knowledge of the principles of economic science.

1.—Prices, as determined by the equilibrium of demand and supply. Correlation of statistics of production with statistics of consumption to show the adjustment of supply to demand.

2.—Studies of cost of production. Under certain conditions price tends to be in accordance with cost of production; but under other conditions it is the price which determines the cost of production. Of what value is cost of production after it has been determined? What factors must be considered in determining the cost of production with a view to ascertaining the price?

3.—The relation of freight rates to prices and to production—who pays the freight rate?

4.—To what extent are domestic prices affected by foreign (or international) market prices?

5.—A complete study of the market for each of the great commodities, in order to show what effects marketing costs have upon prices to the producer and the consumer.

6.—A complete study of the distributive process for each of the great commodities to find the cost of sending each commodity through the various stages to the final consumer. This should include the risks, the handling charges, the charges for grading, inspecting, assembling, processing, wholesaling, jobbing and retailing. Only by such a study can we form any adequate comprehension of the services and remuneration of the series of intermediaries between producer and consumer. This study should be carried out with the view also of discovering, if possible, a means of economizing in these distributive expenses.

7.—A study of land policies and their effects upon general prosperity and the increase of national wealth. Has the homestead system been a success? To what extent have good lands got out of the hands of cultivators and into the hands of those private owners and companies which are holding them in order to make large profits in future through securing the unearned increment?

8.—Taxation in relation to land utilization.

9.—Under what circumstances and to what extent can the producers undertake all or any of the marketing functions with a view to greater returns to the farmers and greater economy of the system?

10.—We should have a series of studies made in connection with the chief agricultural products to show the lines of development which we have followed and to chart out the future policy to be pursued. Insurance companies have made a study of the probabilities of life and death and upon the basis of this information they determine their financial risk with each policy holder. They are building up their business upon the basis of risks, but these risks have now become calculable. Should not the farmer, who is operating each year under great risks, chart his business until he too may be able to carry on his work under conditions which are calculable? To be able thus to minimize the risks would change the entire character

of farming by making greater certainty in the enterprise.

I have pointed out only a few of the economic questions which we should have investigated. It will be noted that for this work a comprehensive knowledge of economic science must be a prerequisite.

II.—The Proper Adjustment of Rural and Urban Industry

In all productive employment there is a balancing of the productive factors which will yield the largest results; that is, there is a certain grouping of the labor and capital with land which will produce the greatest amount of product. To reach that point should be the aim of the manager of the enterprise and he is continually experimenting to find out under what conditions he is likely to attain that stage. Economic life seeks to establish such a balance of economic forces as will give the largest measure of advantages over disadvantages. To use an analogy from the domain of natural science: if we suspend from the ceiling of a room by means of strings a number of balls, in such a way that they form a row; and if we then draw out the ball at one end of the row and allow it to fall back and knock the one next to it, we shall find that when this blow has been communicated to each ball in turn the last ball will be knocked outward to the same distance as the first ball was drawn out—that is, supposing all the balls are alike. In the language of science, action and reaction are equal and opposite. But when this motion that has been imparted is allowed to work itself out there will be reached again a state of equilibrium under which the forces will be in balance. Nor is this something which lies within the realm of the abstract; the truth is that these forces can be measured and we can set down by scientific formula the conditions under which equilibrium will be attained. So, too, in economics; the balancing of the forces is not something which is merely concerned with the philosophical discussion of the abstract. The conditions under which this economic balance may be attained can be definitely set down and reduced to the reality of the concrete. We may go even further than this and say that life itself is a balancing of the great forces; for what is character except the balancing of the elements of good against the elements of evil with the object of securing the largest measure of the good?

Naturally, then, since agriculture and other enterprises compete for the available supplies of labor and capital, and even in some instances for the land, it becomes an important question to consider the circumstances under which these urban and rural enterprises are in the proper adjustment with each other. Now it may be laid down as axiomatic that so long as labor and capital move away from agriculture and find their employment in urban industries, and so long as this process takes place continuously, the agricultural enterprise is not in a proper adjustment with the industrial and commercial pursuits. It is evident that where labor and capital turn away from agriculture and seek employment in towns and cities, the important reason for this is that the reward of labor and capital in agriculture is lower than in other kinds of employment.

In the case of urban industry capital is free to move from one employment to another according to the relative advantage. If capital invested, say, in shoe manufacture is yielding a lower rate of return than capital invested in textiles, the capital in the former may be transferred year by year from it to the textile industry. This is accomplished by means of the replacement fund. The shoe manufacturer must set aside each year out of his earnings a certain sum so that when his machinery is worn out or becomes obsolete he will have enough in this replacement fund with which to purchase new machinery. But if the return on capital is lower in shoe manufacture than in textiles this man may invest each year's replacement fund in the textile industries, so that by the time his shoe machinery is no longer useful he has all his capital in the more highly remunerative employment. Capital is free to move from one such enterprise into another which is more profitable.

But we cannot say the same thing of agriculture. Land is not like the machinery of a factory, it is not being worn out and sent to the scrap heap. Capital, when once invested in land, is there to stay. The land may change ownership, but the capital cannot be withdrawn from it in the same way as in manufacturing. The land will be there after generations of workers have passed away. And when the return on agricultural capital has become reduced it is almost impossible to transfer the land by sale from one to an-

other. As soon as agriculture has become unremunerative no other person than its present owner wants the land; the present owner therefore must go on cultivating the land, and this simply makes the evil so much worse. The landowner can't stop producing and to go on producing at a loss only aggravates his condition.

In urban industry labor also is free to move from one employment to another. A laborer who can tend a machine in a cotton factory can quickly learn to tend a machine in any one of a great many other factories. So long as he can tend his machine he does not need to know much about the business, for the superintendent, the foremen and other officials are directing the whole organization. In manufacturing much of the machinery is automatic or semi-automatic, so that the laborers do not need to have anything more than ordinary alertness in order to hold their jobs. But the conditions are altogether different in agriculture, for the laborer, in order to carry on his work with satisfaction, must be thinking of his work and planning for it. This is true whether he be the owner of the farm or an ordinary employee. There is nothing automatic on the farm and the worker in order to be effective must be interested in his work and have detailed knowledge of the work in which he is engaged. If he is handling a dairy herd or using horses, any mistake in regard to their feed or other treatment may prove serious. The knowledge which a farmer or farm hand must have embodies so much science that a worker cannot shift from a factory to a farm at will in response to the economic conditions. The freedom of movement of labor which is so characteristic a feature of industrial employments does not hold in the case of farm work. Evidently, then, in the case of labor, as in the case of capital, the movement into agriculture is not made except under strongly pronounced inducements acting over a considerable period of time. On the contrary, the freedom of movement of labor tends to drive labor away from agriculture, into industrial and commercial life where very little, if any, specialized training is needed in order to gain admittance.

When the returns to labor and to capital are larger in other pursuits than in agriculture, it is manifest that these productive factors will avoid the field of agriculture. How can they be attracted to this fundamental field of employment? If we look into the conditions attending industrial employment, we shall find that if capital and labor shun a certain kind of enterprise on account of the risky nature or otherwise uncertain character of that enterprise, and if the enterprise is one which is necessary for the welfare of society, the prices obtained for that particular commodity or service are sufficiently high to draw capital and labor into the enterprise by reason of the high profits which are obtained. This would seem to point the way in the case of agriculture. Until the profits in the latter are considerably higher than at present capital and labor will choose to enter other lines of employment. Since agriculture is attended by so many risks the natural result would be to have the profits all the higher for those who remain in it; and in order to have higher profits there will have to be higher prices for farm products, or else a much lower cost of production than at present — or possibly both these conditions. Higher prices seem to be possible of attainment only through organized activity of farmers, for the individual farmer is no match for the organized commercial men with whom he must deal in selling his commodities. Until farmers can become strongly organized, so as to be able to deal as groups with strongly intrenched commercial interests there is little hope that the surpluses of farm supplies will sell for higher prices in the markets. In order to secure an adequate supply of labor and capital in agriculture, therefore, there must be organized effort on the part of the farmers so that the farm will be more profitable. The logical outcome of insufficient profits for the farmer will be the curtailment of production; this will make itself manifested in higher prices to the consumers in cities and towns, and when the consumers find ultimately that they will have to pay higher prices in order to have their wants satisfied the time will be ripe for higher prices and higher profits for the farmer. Then capital and labor will turn toward the field of agriculture.

One of the best tests of the well-being of an enterprise are the rewards obtained by capital and labor in it. A recent investigation in the United States, where the condi-

tions are much like those in Canada, has given us some illuminating facts which are well worth pondering. In terms of the prices of 1913 (the year before the war-time changes) the average reward per farmer for labor, risk and management was:

In 1913	$444
In 1914	454
In 1915	484
In 1916	534
In 1917	705
In 1918	826
In 1919	833
In 1920	219

In other words, the farmer's return in 1920 was less than one-half of that in 1913. The nature of the risk involved in agriculture will be apparent by a consideration of the figures for 1919 and 1920; for when it is seen that the farmer's income in the year 1920 was but little more than one-fourth of what it was in 1919 we are forced to acknowledge the uncertainty attending the operation of the farm.

A comparison of the labor income of the farmer with that of workers in other lines will also help us to visualize in a general way the significance of some recent changes. Again we take our statistics from the United States conditions:

	1913	1918
Average wage per farmer (for labor, risk and management)	$444	$1,278
Average wage per mining employee	775	1,280
Average wage per factory employee	705	1,147
Average wage per railway employee	782	1,394
Average wage per banking employee	930	1,461
Average wage per government employee	823	895

In connection with this table we must note that the figures given are not reduced to a common base, such as were those of the preceding table; they were the figures which were based upon the great enhancement of wages that had taken place during the years of the war. They do not represent in any sense the relative purchasing power of the dollar. It will be noted from the table that the labor income of the farmer in 1918 was practically the same as the wages of a mining employee, a little more than the wages of a factory hand, somewhat lower than the wages of the railway employee and considerably lower than the average wages of a banking employee. Yet we must remember that the mine worker, the factory laborer, the railway employee and the bank clerk assume little, if any, risk and have no obligations concerning the management of the establishment in which they work. When these factors are taken into account it is clear that the farmer's return for all three services is greatly out of line when compared with the rewards in the transportation and banking business. Considering the farmer's risk, his fixed investment, the dangers to which his crops are subjected, the diseases which prey upon his animals and the uncertainties of his markets, his profits are very low. If he paid his family for their labor, the interest on his capital would frequently be *nil*.

But the best test of the relative position of the rural and urban industry is the exchange value of their products. How much of the farmer's commodity is necessary to be exchanged for a given amount of a manufactured commodity? In considering this I shall take typical products in each case. In 1913, at a certain point in Manitoba, No. 1 Northern wheat was selling at the farm for $1.00 per bushel. At the same time the price of a pair of shoes was $6.00. Therefore it took 6 bushels of wheat to purchase a pair of shoes. But in 1921, at the same farm, wheat was selling at 88c. to 90c. per bushel and the same grade of shoes cost at least $10.00 a pair; so that in this latter year the farmer had to exchange at least 11½ bushels of wheat for the pair of shoes. In other words, the farmer's purchasing power was only about one-half what it was in 1913. Is any further proof required that there must be an entire readjustment of the returns from agriculture, so as to make them more nearly commensurate with those obtained in industrial and commercial life?

How is this readjustment to be attained? In the period since the war, when deflation of prices was taking place, those prices declined least and declined least rapidly which were strengthened, if not controlled, by highly organized groups of producers. It would seem that this points the way to what we have already mentioned, that is, the need for farmers to become strongly organized in

order to resist the pressure towards undue price reductions. If the farmer is going to get upon a satisfactory basis of operation and stabilize his business, he will have to associate himself with others in such an organization as will enable the farmers to control the supply of the product they produce. The demand for the great commodities has been fairly well stabilized and not until supply also becomes stabilized shall we see stability of prices or anything approaching it. So long as the supply is put upon the market in driblets and at uncertain intervals —that is, so long as the supply is not regulated — there will be all kinds of opportunity for depressing the farmers' prices and keeping his return from his business much below that in other lines.

III.—Conditions of Stability or Permanence of the Agricultural Population

It must be understood that I am not speaking here of the permanence of agriculture. That is an assured fact, for so long as there are cities and towns there must be agriculture in order to furnish the food supplies of the consumers and the raw materials of industry. But I am speaking of the stability of the agricultural population which is a no less momentous subject than the permanence of agriculture. When we contrast the agricultural population of an old country like Great Britain with that of a new country like Canada we see that in the former the rural population is fairly permanent, and the English farmer will boast about the number of preceding generations of his family who have been on the same land which he cultivates. But in a new country like our own there is an ebb and flow of the agricultural population which does not contribute to the building up of a healthy and durable community spirit and of permanently successful and helpful community institutions. In a locality where the old settlers and their descendants have held their places for a long time, there is the formation of a well recognized sentiment that the tone of the community must not be allowed to deteriorate, and this is a potent factor in keeping out undesirable elements and attracting men and institutions which will be helpful in sustaining and even improving this moral and material welfare. Capital seeks investment in good communities, but endeavors to avoid those in which the plane of life is not so high or in which there are disintegrating tendencies. I need not trace this subject further; enough has been said to show that permanence is highly important in an agricultural people who would establish their community upon a firm basis.

What, then, are the conditions upon which this stability of population depends?

In the first place, there must be equal social advantages in the country with those in the towns or cities. We do not mean that the country must have the *same* advantages as the city or that the social life and institutions of the city must be transplanted into the country. It would be a sorry spectacle for the people in the country to try to ape the ways of those in the city. But the country people should develop their own social life and the means for its expression in the most congenial forms appropriate to the country, and to such an extent that there will be an equalization of social advantages in the country with those in the towns and cities.

In the second place, we cannot expect stability of an agricultural population unless the educational advantages of the country are the equivalent of those in the urban centres. There is something in family life which leads to placing great emphasis upon education as the means of raising the character of the personal life and developing wholesomeness of human relations. It may be that a family may have to remain in the country without these educational opportunities, but if an opening is afforded or can be made by which they can get to the city and give the young people the educational equipment for a higher position, that family will not hesitate very long before moving away from the country. There is no doubt, but that at the present time the facilities for securing an education are much greater in the cities than in the country. It is pretty clear that in order to hold good families in the country the educational opportunities available in the country must be greatly improved. The importance of the consolidated schools cannot be over-emphasized, but along with the teaching of public school subjects there should be provision for instruction in high school subjects also. It is impossible to have a democracy with part (a large part) comparatively illiterate and the remainder fairly well educated, just as it is impossible

to have a democracy partly slave and partly free. If we are going to have a real democracy in which the people rule we must have an educated democracy, and to this end the half of the population living in the country should have equal educational privileges with those in the city.

In the third place, there must be a satisfactory return upon the land, labor and capital employed in the country if country life is to have a sufficiently strong attraction for the ambitious and the enterprising to keep them upon the land generation after generation. Without this, no tie, not even a sentimental tie, will bind them to the soil and induce them to continue upon the land over a long period of time. As the conditions are at present and have been for some time, the labor of the farmer's family is not remunerated at all equal to what could be obtained by leaving the farm and going to work in the town or city; and it is chiefly the home ties which hold the young men and women on the farms as long as they remain. It does not take long for them to learn that the great world beyond the farm has greater opportunities for them, and with the thought of making their own way in the world they do not take long to decide between the poorly-paid work on the farm and the more highly-paid employment of the factory or the commercial establishment. In the face of this drawing power leading them to leave the farm, it will require an equivalent recompense (although not perhaps entirely in money) to keep them attached to the farm. How can these higher wages be paid? In no other way than by the farmer being able to secure higher prices for what he has to sell, for he can only pay higher wages to the members of his family when he receives greater returns from what he has for sale.

Lastly—and upon this I wish to lay a good deal of emphasis — permanence of the agricultural population upon the land depends upon the maintenance by them of an efficient standard of living. Analogies drawn from other realms may not hold true in every particular, but they may be useful notwithstanding in impressing some central truth and with this object in view I may be permitted to mention two or three. As early as the middle of the sixteenth century it was recognized that cheap money will drive out dear money unless the former is freely convertible into the latter. Again, those who are familiar with the earlier life on the western prairies will remember that so long as cattle only were allowed to graze upon the land they flourished; but just as soon as the sheep were introduced and were allowed to graze with the cattle and so long as both were allowed to multiply the sheep gained the advantage and the cattle were driven from the ranges. The reason for this was, of course, that the sheep could nibble closer to the ground and could, therefore, live on pasture which would not support cattle. Something akin to this seems to be true in the case of human beings. Those who have a lower standard of living, that is, those who can live and multiply upon a small income will tend to displace those who will not live and multiply except upon a larger income. This is well exemplified upon the Pacific coast, both in British Columbia and California, where the cheap Oriental labor will take away the jobs from the native laborers in work which can be done by either. The one can live and work where the other cannot live upon the same wage. The early immigration into the eastern part of the United States has driven out the native worker from some employments, such as coal-mining, and now that the earlier immigrants or their children have risen in the social scale they in turn are being displaced by the later immigrants. So, in the case of farming, those who are willing to live on a lower, that is, less expensive, standard of living than the native farmers are driving out the latter, for the reason that being more saving and thrifty they can bid a higher price either for the rent or for the purchase of land than can the native farmer with his more expensive standard of living. It is for this reason chiefly that in British Columbia and California the Japanese have been taking the land away from the native farmers. But the same reason accounts for larger and larger amounts of land in the Province of Ontario getting out of the hands of the native and into the hands of those who are not natives of this province. In recent years a foreign element, to the number of about fourteen thousand it is estimated, has taken up land in one of the finest sections of the province between Toronto and St. Catherines. The fact is well known that in certain localities where the land is very valuable the native farmers are leaving the land and going to the towns and the land is coming into the possession of those thrifty elements of French Canadian stock who can

pay the highest price for it. It must not be supposed, however, that all people with low standard of living have high competing power; but those people who have a lower standard of living and equal industrial efficiency seem to be supreme in the matter of economic competition; in other words, it is not the cheap standard, but the efficient standard that wins.

The economic value of a man to his country depends upon the amount by which his production exceeds his consumption; that is, his contribution to his country's strength and wealth is equal to the difference between what he adds to its resources and what he takes or consumes from its resources. There are, therefore, two ways in which a man's economic value may be increased: first, by increasing his productivity, and, second, by keeping his consumption within efficient limits. The nation which will win against another in the struggle of economic competition, supposing both to be equally efficient as producers, is the one which has the wider margin between production and consumption.

It must not be supposed from what we have said that an expensive standard is inconsistent with efficiency in production. In the case of many people, just as soon as they begin living on the expensive standard a large amount of their income goes for those luxuries and elements of display which do not maintain them as efficient producers. They cease to keep themselves keyed up to proper pitch for the best productive effort. On the other hand, if while living upon the expensive standard they spend their income upon such foods, social life, relaxations, amusements, reading and study as will keep them phyisically fit and mentally keen and alert, their productive efficiency may be maintained or even increased by their high standard of living.

It is, therefore, highly desirable that the farming community should have available everything which will give mental stimulus, wholesome recreation and the best education to fit them for holding their own, and even for making large advances, in the realm by domestic and international competition. Only in this way can the native population retain their hold upon the land of their ancestors and carry on from generation to generation the spirit and the institutions which have been handed down as worthy monuments from the past.

There is the opinion in some quarters that if we can keep out of the country those which have the lower standard of living we shall be safe from any effects of their competition. This is not true. In reality, by this course we are simply widening the field of competition from the domestic and national to the international. In the international market that people which can put their products for sale at the lowest price, provided they are equally good, will outrival those who cannot produce these same products except at a higher price. So that really the low standard of living, if it be efficient, will win the day over the high standard which is not more efficient. It is the rational and productive standard of living which must be maintained among the rural classes, as well as other classes, if the native is not to be displaced by those of lower standard.

IV —The Effects of Borrowed Capital

In order that we may have a clear background for considering the effects of borrowed capital, some preliminary statements are necessary as to the character of the farmer's business and his need for credit facilities.

In recent years, both in Canada and the United States there has been a great movement for providing farmers with credit. Legislatures, provincial, state and federal, have been seeking means by which credit could be granted to the agricultural classes upon a basis that would be commensurate with the credit facilities of the industrial and commercial classes. Farmers' organizations of all kinds have passed resolutions in favor of additional credit and governments have listened to these appeals and have in some cases adopted means by which effect was given to this desire for credit. We are confident that in some instances farmers could profit by an acceptable line of credit; but we are equally confident that more care has been taken to provide for credit than to protect the welfare of the farmers against the use of too much credit. Too much attention has been devoted to the benefits which, under certain conditions, are possible from the employment of borrowed capital; and not enough attention has been given to the other aspect of the problem, namely, the disadvantages which ensue from undue borrowing.

Credit may be of two kinds, productive and unproductive. The man who borrows money in order that he may secure a larger amount of consumers' goods and services for the gratification of his wants is on the way of danger. If he borrows in order to get an automobile so that he can do more travelling for pleasure, or to get a high-priced automobile merely to keep up with one or two of his neighbors who have high-priced cars, he is "spending for that which is not bread." Capital used in that way is economically unproductive; it does not contribute to the creation of additional capital. It is consumed in gratifications and pleasures. The same thing may be said of any expenditures which are made merely for display, for vanity or for excessive or luxurious living. But capital which is invested in valuable machinery, improved live stock, better buildings and in the means of education which make the farmer's mind more alert and give him the latest results of scientific investigation along his line of work, is productive capital. It enables the farmer to apply his own labor and capital more effectively upon his farm. It will yield not only enough return to pay interest on the capital borrowed and to repay the principal of the loan, but also an additional or extra profit to the competent farmer. It does not require any more than ordinary judgment today to see that many farmers have far too heavy obligations in the way of borrowed capital.

Three kinds of credit are needed by the farmers who have the ability to use them wisely. In the first place, there is a need for *short-term* credit extending over the productive year. By having this means of purchasing improved seed, of hiring additional labor at critical times such as seeding, harvesting and threshing, of purchasing feeders or stockers, of securing the best feeds for dairy cows or fattening stock, etc., the good farmer is frequently able to obtain much higher returns from his labor and farm management than if he had to be satisfied with his own capital. Not infrequently a farmer could get a bargain in purchasing one or several head of stock if he could only secure accommodation at the bank in the form of credit while his own capital is tied up for the time being in other productive forms. Then, too, the farmer of ability could often turn his winter months to better account if, by access to a source of suitable credit, he could purchase animals for ripening off into a good quality of beef. This short-term credit would also be valuable in enabling the farmer to market his products in a more orderly manner; instead of throwing his products on the market just when others are doing the same thing and thus getting low prices because of the glutting of the market, the farmer with good credit could hold his commodities and take advantage of the higher prices at a later time when the market had reacted. Agriculture is a risky business and we do not wonder that the interest rates charged to the farmer for loans during the productive period are high, for even slight ravages of insects, blight, drought, frost, excessive rain, etc., may cause the investment of the borrowed capital to be completely or largely wiped out. But when the crops have passed this stage and have been safely harvested or when the returns of other kinds from the year's work have been assured, it would seem but fair that capital in larger amounts and at lower interest rates should then be available for the farmer in order to enable him to hold his products until the most favorable turn of the market.

In the second place, the farmer needs *long-term* or mortgage credit, that is credit which he may have for periods of five to thirty-five or forty years. This is required to enable a farmer, and especially a young man, to buy land and pay for it out of the proceeds of the farm. Occasionally a five-year term is long enough, but usually the more acceptable term is thirty years, with the privilege of paying off the whole amount or any extra portion of it at any time after five years. An appropriate system of long-term credit would also permit many a tenant of ability to become an owner rather than a tenant farmer, with all the community advantages which would accrue from ownership.

In the third place, the farmer needs what we may call *intermediate* credit, that is credit ranging in duration from two to five years. This is necessary for such purposes as draining land, putting in home conveniences (as, for instance, a water or an electric light system), putting up better dairy barns, securing better equipment (such as better machinery or silos), investing in pure-bred stock, etc. These things would not pay for themselves within a year, and yet the farmer would not want to put one or more small mortgages on his place in order to provide

for them. Moreover, it costs money to place a mortgage on a farm. This should not be necessary. Provision should be made that such intermediate credit could be secured without the expense of a mortgage.

We now turn to study the effects of borrowed capital. The first effect of borrowed capital is that it permits of a more intensive use of the farmer's own capital, labor and land. Sometimes the farmer does not have enough capital of his own to make the most economical combination with the land and labor at his command, and under these circumstances it might be much to his advantage to borrow some additional capital. For example, the farm family may be too large for the size of the farm and it might be highly profitable to buy another farm near at hand, by means of long-term credit. By so doing there would be fuller scope for the labor that was available and sometimes the same amount of machinery, when properly handled, would be sufficient for working both places. It is evident that here there would be a more intensive use of the labor and capital involved and the money returns therefrom would be correspondingly greater. Or, on the contrary, the amount of the land held by the farmer may be too much for the small amount of labor and capital he may have; and if the farmer has the ability to use more capital and direct more labor on the same farm he is wasting his time and effort in carrying on his work without having the necessary working capital with which to obtain suitable equipment and employ additional labor. I have already noted the way in which a more intensive use of the capital, labor and land may be attained by having the winter months more fully occupied.

The personal aspect of this must not be over-looked. A farmer develops his ability for larger things by being placed in contact with the opportunity for them. By using to the greatest degree the resources which he has, he will develop his ability to accomplish still greater things. Business ability, even in the case of the farmer, is not born with him, but evolves according to the measure to which he uses what he has and to the extent to which opportunities are open to him. In the case of many a farmer he has not the ability to use credit because he has never been able to command it. "To him that hath shall be given," applies as much here as in the realm of the personal life of the individual. Of course, the farmer should learn to use borrowed capital gradually, by increasing the amount borrowed through careful stages and noting the results at each stage. Here, as in urban enterprise, business ability is a progressive unfolding of the individual power and the slow but sure development of this quality from lower to higher gradations should be the aim of the farmer.

Then, the increased amount of capital available for investment in land brings a ready response in the increased value of the land. Where land is thought of only as an investment its value will be determined by the amount of the return which it will yield. But even where the land is worked by the owner for the satisfaction of having a good home, the investment value is still an important consideration. If the return from it is not such as he could obtain in other fields of activity through the use of the same amount of capital and the expenditure of the same amount of effort, the sentimental tie of home usually weakens and he moves to the place and into the line of activity in which his return is the largest. Now the natural tendency is that the value of land changes inversely as the rate of interest on an investment of that kind. For example, if the net rent of a piece of land is $300 per year, and the rate of interest on such an investment is 4 p. c. the value of the land will be $7,500; but if the rate of interest be 5 p. c. the value of the land is only $6,000. Before the war, when interest rates were declining, the value of land was progressively rising. This was amply attested in the United States, for after the establishment of the Federal Farm Loan system by which capital at low rates of interest was made available more abundantly, the land values took an almost immediate slant upward. Unless there is some counterbalancing influence this increased value of land will invariably follow the more abundant capital available for use in agriculture and the lower interest rate. No means has yet been devised to prevent increased land values under these conditions. The question is sometimes asked. — If that is the case, does it make the purchase of a farm any easier to have a system of long-term credits with low interest rates? I must leave that unanswered since it is not germane to the subject in hand.

But it is to the financial effects of borrowed capital that I would direct most at-

tention. I must recall here the fact that agriculture is a business which shows wide variations of results from year to year, and these results are not within the control of the farmer. A good crop one year may be followed by several years of poor crops and by even an occasional total failure. The reasons for these will be at once apparent to those who are familiar with farming operations. The changing seasons, the numerous pests, the recurring alternations of too little and too much rain-fall, the late frost in spring or the early frost in autumn, the devastations of hail, and other circumstances are too well known to need more than mention to anyone who is acquainted with all parts of Canada. Farming is a highly speculative enterprise. Ocasionally several good years together will seem to more than overbalance the poor years, and then come the very opposite conditions when a succession of bad years will almost paralyze the agricultural interests. This being the nature of agriculture, from the fluctuating character of which we have no knowledge as to how to obtain relief, it is necessary for us to ask with the greatest seriousness, what are the financial effects secured by borrowing capital in a business of this kind?

In order to put this matter in concrete form I have introduced the accompanying table. A, B, C, D and E represent five farmers, each having the same amount of land and of the same fertility. Each farmer has the same ability and all have equal capital investment, namely, $12,000. A is the only farmer who borrows no capital for the year's operations. All the others are borrowers, B using $650 for the year's operations, C $1,500 for the same time, while D and E borrow $3,000 and $5,000 respectively for the year's use. I think a study of the table will make clear the following conclusions from it, namely, that the financial effects of borrowing are:

1.—To greatly increase the profits of normal and good years.

2.—To accentuate the losses of poor years.

It will be noted also that the greater the amount borrowed the greater will be the profits in normal and good years—provided the amount borrowed be not in excess of the farmer's ability to use it properly—and the greater will be the losses in poor years.

Do good years and normal years exceed the poor years? If so, a farmer of ability may be able to use some borrowed capital to advantage. Do poor years exceed the normal and good years? If so the net result

	A No borrowed capital			B Borrows $650 at 6%			C Borrows $1500 at 6%			D Borrows $3000 at 6%			E Borrows $5000 at 6%		
	Normal Year	Poor Year	Good Year	Normal Year	Poor Year	Good Year	Normal Year	Poor Year	Good Year	Normal Year	Poor Year	Good Year	Normal Year	Poor Year	Good Year
Gross income	$3000	$1800	$3500	$4000	$2000	$5000	$5000	$2500	$6000	$6000	$3000	$7000	$8000	$4500	$9000
Working expenses	2000	1000	2200	2500	1200	3000	3200	1800	3800	4000	2400	4500	5500	4000	6000
Net income	1000	800	1300	1500	800	2000	1800	700	2200	2000	600	2500	2500	500	3000
Interest on borrowed capital	....	....	....	39	39	39	90	90	90	180	180	180	300	300	300
Return on owner's investment	1000	800	1300	1461	761	1961	1710	610	2110	1820	420	2320	2200	200	2700
% rate of return	8 1-3	6 2-3	10 5-6	12 1-6	6 1-3	16 1-3	14 1-4	5 1-12	17 7-12	15 1-6	3½	19 1-3	18 1-3	1 2-3	22½

of borrowed capital is sure to be disastrous. Have these facts been placed squarely before the farmers by those who are encouraging them to use borrowed capital or credit? I am convinced that they have not.

Upon these principles, then, should the farmers decide whether to use credit or not; and the same principles apply to the intermediate or long-term credit as we have outlined here for short-term credit.

W. T. JACKMAN (left) and A. B. MACALLUM, whose lectures at the recent C. S. T. A. Convention are published in abstract form in this issue.

The Vitamins and their Relation to Animal and Plant Nutrition

By Dr. A. BRUCE MACALLUM

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(Abstract of two lectures delivered at the C. S. T. A. Convention)

The vitamins comprise a group of compounds which are essential for the orderly regulation of the animal metabolism. Their function is not, as with the ordinary elements of the diet, concerned with the provision of energy and tissue repair but with the regulation of the metabolism of the fats, carbohydrates, lime and phosphorus in some manner as yet unknown. They owe their discovery to the fact that certain pathological changes appear in the animal organism when it is forced to subsist on diets low or totally defective in these essential factors and subsequent research has defined a series of abnormal states known as "Deficiency Diseases" which follow the consumption of a vitamine free diet.

Three members of the vitamin group have been definitely identified. These are known as the Fat Soluble A, the Water Soluble B or antineuritic factor, and the C or antiscorbutic compound. These elements are in all probability organic compounds of a simple structure, since two are dialysable and all have the property of exerting their functions when present in the most infinitisimal traces. Indeed, the amounts usually present in food stuffs is so small that it has been impossible to economically concentrate a sufficient amount of material to yield quantities sufficient for modern methods of analysis. One property common to the series is that the physiological activity of the members of the group can be partially or totally destroyed by the action of heat, oxygen and the alkaline ranges of reaction of solvent media. This destruction is probably not brought about by decomposition of the molecule itself but by an isomeric change taking place and an inactive form resulting from the operation of these various adverse factors. Finally there are no chemical methods by which the individuals or the group can be identified and recourse must be had to biological methods of the type of feeding experiments for their detection.

The antineuritic vitamin was the first member of this group to be isolated as a distinct factor and was the result of observations upon beri beri, a disease endemic in Asiatic rice consuming nations. It was known for some years previous to this that this condition did not arise when unmilled rice was consumed and that the preventive factor was located in the millings which contained the germ, bran and aleurone layer of the rice grain. The production of experimental beri beri upon fowls by Eykmann opened up this new field and led to important discoveries as to the nature of the curative substance.

The water soluble factor has subsequently been found in other food stuffs than rice. It is present in the germ and aleurone layer of all cereal grains, and in cattle products such as milk, egg-yolk, and butter. It is found in small quantities in the muscular tissue of stock animals. The compound itself is water soluble, dialysable and insoluble in practically every organic solvent, but it can be dissolved in alcohol water mixtures up to 90 per cent. alcohol. It is probably basic in nature since acid solutions promote the extraction. It will withstand the action of fairly concentrated sulphuric and hydrochloric acids even where these are boiled for some hours without depreciating its protective function. Solutions whose reaction is faintly acid will retain their activity at room temperature for weeks but will lose their antineuritic properties when autoclaved at 120°C. for a few hours and partial loss takes place at temperature ranging from 100-120° C.. If the reaction of the solution is alkaline the functional activity tends to disappear at temperatures from 50-100°C. The natural food stuffs can be stored indefinitely without appreciable loss of antineuritic power. Various attempts have been made to separate it by the use of the alkaloid reagents but phospholungstic acid and a combination of silver nitrate and baryta are the most effective means of getting an insoluble metal salt. A preparation with extremely potent curative power has been prepared in this way

but large quantitites of raw material have to be worked up to get even a few decigrammes of the antineuritic compound. In one case a gramme or so was obtained from a ton of rice millings. Attempts to reduce these semi-pure preparations to further subdivision have resulted in the destruction of their therapeutic power by the chemical technique employed by the various investigators and this has been the principal obstacle to the ultimate identification of the various members of the vitamin group. Absorption media such as clay, fuller's earth and charcoal and other materials possess the power to take up the vitamin from solutions. This amount so separated varies with each absorption material but is never complete.

The concentrated preparations give some of the general reactions of the pyrimidine group and investigations in regard to the known members of the pyrimidine and purine groups have demonstrated that some of these compounds display a partial curative action upon experimental beri beri, varying with the particular compound studied, but in no way comparable with the activity of the antineuritic substance itself. It has been tentatively suggested that the curative element may be an isomer of adenine and claims have been made that a-hydroxy-pyrine can exist in two crystalline forms one active and the other negative in its behaviour to the disease.

The physiological activity of the water soluble accessory is not concerned alone with its activity in protecting the body from the onset of beri beri but it is the vital spark which activates the nervous system and it also can stimulate very powerfully the secretion of the digestive organs and produces active penistalsis of the musculature of the intestinal canal. It also is an important factor in the storage and metabolism of the carbohydrates. These seems to be a definite amount of this accessory required to treat a certain quantity of sugar since by increasing the sugar portion of the diet attacks of beri beri can be developed sooner than the case where the carbohydrate is low. A relative deficiency may take place by increasing the sugar intake without a corresponding increase in the consumption of the accessory factor and finally produce a mild chronic deficiency disease.

The antiscorbutic factor like the water soluble accessory is also soluble in water and dilute acids and insoluble in the usual organic solvents with the exception of dilute alcohol. It can be dialysid wholly or in part depending on the size of the pores of the semi-permeable membrane. It is extremely thermolabile and loses its curative activity when the solutions are heated at various ranges up to 100°C., the degree of destruction being a combination of the time and temperature factors and is due to the action of the atmospheric oxygen since its solutions can be boiled for hours without depreciation if oxygen is excluded from the vessel. Oxidizing agents, such as peroxide and permanganate, can completely eliminate its therapeutic power. It can not exist unchanged for any period of time unless the reaction of the medium is acid, and alkalies and food preserving agents will quickly reduce the antiscorbutic power of various food stuffs to zero at ordinary temperatures and dessication of ordinary antiscorbutic food stuffs in their original state will produce a like result. Autoclaving at 120°C. for one hour effects complete destruction in neutral media.

This substance is widely distributed in nature in the living cells of plant tissues but to the greatest extent in fruits of the citrus type and to a lesser extent in all fruits whose juices are acid in reaction. Green leaves also possess a moderate protective power, a property shared in common with tuberous roots of which the suede turnip is the principal exponent. These roots possess their therapeutic power when they are stored with the cells in their normal turgid condition but lose this if subjected to dessication. Cereal grains in their dessicated condition are likewise inactive but their antiscorbutic action is restored by the process of germination. The citrus group of fruits is *par excellence* the chief source of the active compound and the acidity of fruits generally enables them to undergo prolonged storage without serious impairment of their physiological power.

While the juices of the lime and lemon have been popular on account of their antiscorbutic powers concentrated preparations have been made after separation of the organic acids and distilling *in vacuo* to dryness keeping the reaction slightly acid. Concentrated preparations of orange juice have been made on a large scale and have still retained their original activity when stored for periods up to two years.

Milk, contrary to the generally accepted ideas, is not a reliable antiscorbutic since its reaction tends to the alkaline range and promotes the oxidation of this important factor. Pasteurization combined with storage for

more than twenty-four hours usually nullifies its protective power as is the case with all the sterilizing methods in use. It has been determined by feeding experiments that even where fresh milk is used it does not protect unless it is consumed in quantities so large that it must form the sole article of diet. It is now the practice where milk is used for infant feeding to fortify it with pressed suede turnip juice.

Experimental scurvy can be produced upon guinea pigs most readily. A sole diet of rolled oats, bran and water will produce a typical case of scurvy in a few weeks. A small quantity of autoclaved milk is also given daily to ensure a supply of the fat soluble and antineuritic factors and give a clinical picture of scurvy uncomplicated by other deficiency diseases. This method is used in studying the antiscorbutic power of various food stuffs, since these will prevent the disease if active or if inactive indicate their deficiency by the weight curve of the animal under observation showing a gradual loss finally ending in a typical case of scurvy.

The fat soluble "A" factor derives its name since it was discovered associated with the ether soluble portions of egg yolk and butter fat. Alcohol-ether extracts of animal tissues like the liver and kidney also indicated the presence of this compound. Earlier attempts to separate it from its original source in the plant tissue by expression or by extraction with fat solvents proved negative and it was presumed that it existed in the plant cell in a combined form which was hydrolyzed by the digestive ferments of the animal and stored up with the animal fats. Later researches demonstrated that alcohol could remove it from plant tissues and this is now a routine method of separating it from these sources.

It is soluble in alcohol, ether, benzene and partly so in chloroform and carbon disulphide. It can readily be oxidized and lose its activity either by shaking the molten fat with warm water or blowing air or oxygen through the liquid fat. If care is taken to avoid the action of oxygen the molten fat can be heated for hours and still retain its fat soluble accessory unimpaired.

The principal sources of the fat soluble factor in addition to those enumerated above, are plant leaves which contain chlorophyll and cod liver oil. This latter substance is several hundred times more active weight for weight than any other fat soluble bearing material when fresh and crude but partially or totally inactive after being subjected to the usual refining methods. Vegetable oils on the other hand are practically negative as regards this valuable constituent, and consequently butter substitutes which have these as a base are likewise negative. The synthetic power of the plant which produces this factor is associated with the chlorophyll since green cabbage leaves and green algae are fairly potent while the inner white leaves of the cabbage and red algae have proved negative upon biological examination. Plants can produce the "A" factor when grown upon artificial media free of this element and will go on with the synthesis even when the chlorophyll-bearing area is trimmed off and allowed to grow again, but it does not appear till etiolation of the seedling is well under way. When these experiments are carried out under conditions which prevent the development of chlorophyll, such as growing them in a dark room, the fat soluble element is present only in the merest traces being negative for all practical considerations.

This factor is usually associated in natural food stuffs with the yellow xanthophyll plant, pigment carrotene, and this has been used as a measure of the fat soluble content of the material in question with a fair degree of success. Several attempts have been made to identify it with the coloring pigment. However, butter is quite active even when prepared from milk free from carrotene and hens can be dieted to produce an egg with a carrotene free yolk and such eggs can be hatched out successfully. Even butter can be made carrotene free by dissolving in alcohol and removing the pigment with animal charcoal and still retain its original curative and preventive powers. Finally pure carrotene preparations have shown no demonstrable activity similar to that displayed by the fat soluble factor when administered to test animals.

The various fats have been systematically examined to ascertain the source of the accessory function. When subjected to hydrolysis by alkali in an atmosphere of carbon dioxide the fatty acid and glycerol fractions have not identified themselves as the therapeutic element which is obtained by making an ether extract of the residue and this is found to contain the vitamin along with the unsaponifiable fraction of the fat mixture. This method has yielded highly concentrated and very potent preparations of the A factor.

The function of this accessory in the metabolic cycle is largely concerned with the cal-

cium metabolism since it brings about the retention of lime and promotes its deposition in the bone forming areas. A deficiency of the vitamin on children results in a non-assimilation and loss of lime and consequently a deterioration in skeletal metabolism and production of rickets. This latter condition is brought about more rapidly when, together with a fat soluble deficiency, there is a low plane of intake of lime and phosphorus. As an antirachatic substance the principal reliance must be placed on crude codliver oil which is specific for this condition and accomplishes almost miraculous results. The "A" factor is also responsible for the good condition of the developing dentition since a mild deficiency will produce underdeveloped teeth and a predisposition toward caries. Another feature due to a partial chronic deprivation of this vitamin is the development of keratomalacia. Formation of purulent discharges of the cornea and conjunctiva which may proceed so far as to involve complete destruction of the eyeball and it was this feature that first directed attention to the presence of the fat soluble factor.

It is only within the last decade that it was considered that the process of growth in adolescent animals could be influenced by other factors than actual starvation. Rubner's views that growth would take place if a sufficient quantity of calories were supplied of which 5 per cent. must be in the form of protein had dominated the field. But during the course of the investigation of the importance of certain animo-acids instead of employing natural food stuffs, an artificial diet was made up of a fat, carbohydrate, protein and salt mixture which was found satisfactory for growth experiments. Hopkins went a step further and found that this apparently pure mixture after further purification by extraction of the protein and sugar with alcohol did not enable the animal to grow, but decline and death followed. The residue from the alcohol extract when added to the mixture again rendered it adequate. A further series of experiments with the highly refined diet mixtures showed that these enabled young rats to grow if supplemented with 1-3 cc. of milk daily per animal. This extra ration was insufficient to account for the results even from the standpoint of calorific energy and Hopkins claimed that it was explained by the presence of minute traces of some accessory in the milk which supplied the stimulus to enable the growth process to proceed. A series of experiments by other workers also indicated that this accessory was also present in brewers' yeast and could be obtained from a series of various natural food stuffs which were proven later to be carriers of the water soluble antineuritic vitamin. Various attempts to isolate the growth factor resulted in the discovery that it could be separated by phosphotungstic acid and certain adsorptive media and showed these properties in common with the "B" vitamin. It is now considered to be identical with this latter compound.

Most of this work was carried out with feeding experiments of short duration and when carried out for longer periods than fifty days it developed that after about three months the growth curve began to slow up and recede, the animals developing keratomolacia. Apparently another factor came into play which neutralized the effect of the antineuritic vitamin. Only after supplying the ether soluble portion of butter fat did any improvement occur and the animals approach maturity and live the ordinary span of life. This was the first indication and discovery of the presence of the fat soluble vitamin and further research localized this element in the olein fraction of the butter fat. It is evident that unlike the "B" accessory the animal can survive for a protracted period before showing symptoms of a fat soluble deficiency and that the requirements of growing animals are keener than mature ones since the deficiency symptoms appear much sooner in the former case.

In the earlier experiments with rats very little account was taken of the effects of an antiscorbutic deficiency since rats do not develop the typical symptoms associated with this condition. Subsequent experiments with these animals indicate that growth approaches maturity much more rapidly and the final weight is greater if the antiscorbutic factor is present in addition to the A and B vitamins. Guinea pigs are more sensitive to the antiscorbutic deficiency and when deprived of this, even though the other two factors are present in excess, soon cease to grow and lose weight and ultimately develop scurvy. The most recent method for detecting the antiscorbutic factor is by a study of the growth curves of young calves which are fed bran, oats, water and autoclaved milk (1 hr.). This provides a normal diet and the A and B factors and the antiscorbutic factor is ascertained by feeding the material in question and determining its effect in promoting the growth. It is now universally conceded that

in mammals all three vitamins must be present in the diet to effect a normal growth.

Other animal groups beside the mammalia have been found to be dependent on one or more of these essential substances. Frogs and Tadpoles respond to the action of the antineuritic and fat soluble accessories and insects, such as drosophila, cannot reach maturity and reproduce when raised on sterile culture media unless the antineuritic substance is supplied in the form of yeast. The animal kingdom is in the final analysis dependent for its survival upon the synthetic capacity of the plant life of the world, without which it would ultimately become extinct.

Attention has been directed throughout this lecture to the fact that the plant cell is the producer of these all important elements. Studies have been carried out on yeast cells (a prolific source of the water soluble factor) when grown upon artificial culture media. It has been known for years that yeast can grow slowly and prepare its organic nitrogen from an inorganic ammonium salt and subsequently it has been proved that yeast cells obtained from these growths can prevent the onset of the beri beri symptoms in pigeons. But the rate of growth on these artificial culture media can be greatly accelerated where traces of solutions containing the water soluble factor are added to them. The growth will go on until the vitamin is used up and then slow down to a stationary value. The higher forms of plant life also grow to a certain extent on their own synthetic capacity but the growth and development can also, as in the case of yeast, be accelerated by extravenous additions of vitamin in addition to that stored up in the seed. Bottomley in a series of experiments found that the action of the organisms which convert the mumic acids of peat into water soluble material could produce substances which had a marked accelerating influence upon the growth of lentils which were grown in Detmar's solution. The accelerator could be separated by the technique employed in concentrating the antineuritic vitamin. Thus the plant forms must also require some outside supply to carry on beyond the early periods of their growth. Fertilizer and peat which were both fresh contained only slight traces of these accessories which could be increased by the action of saprophytic bacteria. The growth of nitrifying bacteria can also be affected by vitamins so prepared and the soil bacteria can be divided into two classes, the nitrifying type dependent for their development on the accessory factors and the putrefactive, denitrifying and ammonia — forming organisms which do not respond to the action of this group and apparently have no need of them. Thus we have the putrefactive group which decompose organic matter and prepare the vitamin or its precursor and pass it on to the nitrifying organisms who in turn turn it over to the plant in a utilizable form. The latter in all probability build it up into the form known to us as the vitamin group.

Although only a short time has elapsed since research was taken up concerning the vitamins a great deal has been published regarding their properties and distribution but as to their identity, constitution and composition little more is known than at the time of their recognition as a distinct class. The cost of working up large amounts of material, the lack of technical methods for their preparation and analytical methods for their detection is a problem for the biochemical world of the future to overcome.

THE REGISTRATION OF PLANTS

The Canadian Horticultural Council, which was recently organized with headquarters at Ottawa, has already taken steps towards the organization of a system for the registration of new varieties of plants. Through the agency of Mr. W. B. Lobjoit, Controller of Horticulture for Great Britain, the Secretary of the Canadian Horticultural Council will be kept informed of the efforts being made not only in England but on the Continent, to provide a means for the registration of horticultural plants, shrubs, and trees. The Secretary of the Council has also got into touch with the horticultural authorities in the United States who are interested in this matter. It is expected that a conference on the subject will be arranged for during the present year.

REPRESENTATIVE ON COUNCIL OF A. A. A. S.

Dr. W. H. Brittain, Provincial Entomologist for Nova Scotia has been appointed a member of the Council of the American Association for the Advancement of Science, to represent the C. S. T. A.

The Growing and Marketing of Improved Strains of Herbage Plants

R. G. STAPLEDON

Director, Plant Breeding Station,
Aberystwyth, Wales.

(An address at the C. S. T. A. Convention)

It is only with the foundation of the Plant Breeding Station in Wales that we in England—so to say— have started serious researches with a view to improving our stocks of grasses and clovers. You in Canada have been before us, as have our cousins over the border, yet it remains a fact, I suppose, that speaking generally far more critical breeding work has everywhere been done with cereals.

Our great seed trade at home has done excellent work with cereals, and in this connection the work of the late John Garton stands out prominently. In Wales we have no more generally reliable oat than Garton's Record; and the House of Sutton has long stood for great improvements in root crops.

In regard to grasses and clovers our seed trade has been dominated by the importance of high quality seed and has not yet become alive—in my view—to the all importance of *strain*. It is the fundamental significance of strain upon which I desire to dwell today, and after having reviewed some of the evidence from our own work to support my contention, I wish to say something about the difficulties connected with the production of high quality seed of the strains most desired and the keeping of same pure.

In one respect we in England, indeed we in Europe, generally are more fortunate than you over on this side. I refer to the fact that practically all of our agriculturally used grasses and clovers are indigenous to our country. Thus the obvious first step to our critical work has been to institute a detailed comparison between the yielding and intimate botanical characteristics of seed from all the chief foreign sources with that collected from native habitats. We have advanced some way with these trials in respect of Cocksfoot, Rye Grass, Timothy and the clovers and it is perhaps very remarkable that concerning these we are able to make certain all-embracing generalizations.

With reference to the grasses it transpires that the indigenous seed gives rise to plants which produce more tillers than the foreign (a higher percentage of leaf and a higher proportion of barren tillers), to flower later and to be altogether more persistent. With reference to yield we find in the second and subsequent harvest years the indigenous easily beat the commercial; in the first harvest year the yields are closer, some foreign beating the indigenous, but on average figures the indigenous usually come first even in the first year; in the seeding year the foreign almost invariably produce the greater weights.

In a general way the foreign are heavier seed producers than the indigenous, and in any event ripen their seed more regularly and over a shorter period of time. I by no means despair of good seeding habits being met with amongst super-strains of herbage grasses; the seed crop results, however, from a greater number of smaller panicles, at least such is the evidence from Cocksfoot.

In support of what I have said I will quote you the minimum of figures:

	No. of Tillers per plant	Percentage of barrens	Percentage of leaf
RYE GRASS			
Indigenous . . .	251	11	30
Commercial . .	209	4	23
TIMOTHY			
Indigenous . . .	298	68	68
Commercial . . .	144	50	43
COCKSFOOT			
Indigenous . . .	195	44	31
Commercial . . .	127	33	22

I need not trouble you with yield figures, as these and other data are fully presented in a bulletin recently published from my Station.*

* Preliminary Investigations with Herbage Plants, Welsh Plant Breeding Station, Aberystwyth, Wales. Series H. No. 1, Seasons 1919-1921.

We have then a remarkable difference between commercial and indigenous strains. I have not had an opportunity of studying indigenous grasses on the Continent of Europe, but I have little doubt that I should be able to find there the counterparts of our indigenous bunchy and leafy strains. I think, therefore, that we are driven to the conclusion that ever since the so-called natural grasses became commercial commodities, selection has been perpetrated and continued in the wrong direction—in the direction of "seed" and not of herbage characteristics. Naturally people first collecting seed from wild places would obtain it where the species were growing pure, i.e., waste places and so on, and not from dense swards; and then when growing for seed the tendency has always been to take seed from fields seeded down no more than one or two years—a selection, indeed, for the more annually inclined and seed-producing strains.

I think the case of the Wild White Clover which, thanks to Gilchrist and others, is now recognized in England as of supreme value, illustrates this point. We have at my station grown Wild White Clover obtained from numerous sources in England and we find it is the exception for any one lot to consist wholly of the characteristic multi-branched, small-leaved, mat-forming strain, but always a greater or less number of plants occur which are taller and larger and absolutely indistinguishable from the ordinary White Dutch. If now a mixture of Wild White and White Dutch is sown, it will be noted that in the first harvest year it is the larger White Dutch that predominates and if seed were then harvested there would be very little Wild White taken. Thus I feel sure commercial White Dutch clover is nothing but the larger more annual strains selected out of what must originally have been indigenous, by taking seed for generations from leys in their first or second year. So with grasses and clovers alike under commercial conditions selection has been vigourously conducted and in precisely the wrong direction.

Since crossing over I have been much impressed with the extent of the grass lands in the United States and I find the same thing in what little of Canada I have seen. I ponder that Kentucky Blue Grass has on the authority of Piper come from Europe and similarly Timothy, and I cannot help wondering whether the original pioneers of these wonderful colonizers represented the best of our indigenous European strains, or were they, even in those comparatively remote times, semi-commercial strains wrongly chosen and wrongly collected? If they perchance were thus chosen and collected, then indigenous strains of European grass species used in America may afford a promising field of exploration for the plant breeder concerned with producing strains for use over here. Let me only add that in every grass species we have so far studied we find a greater range of variation amongst the indigenous than amongst the commercial, and for our own conditions at all events we are satisfied that for grazing strains as opposed to hay, and for persisting strains, it is from the indigenous we shall obtain them.

I must now say a little about Red Clover which appears to be somewhat different from the grasses and white-clover, inasmuch as the indigenous reds we have so far studied do not appear to be remarkably persistent but rather perpetuate themselves by heavy and early seed production. We have, however, in England and Wales certain wonderfully persistent local strains, many of which have been grown in one district or even on one farm for upwards of one hundred years. These strains have the characteristics associated with the persistent grasses and white clover—numerous branches and late flowering.— They are typical late-flowering reds, running to over two hundred branches per plant, in marked contrast to the easily winter-killed and worthless Italian with its four or five branches; in contrast, too, to our ordinary Broad Reds and even to our ordinary and very fairly well persisting Late Flowering Reds.

Now it so happens that many of these excellent strains are grown and harvested in the west of England under very adverse climatic conditions and so seed of high quality is only obtainable in exceptional years, and is not at all generally handled pure to strain by our large seed houses—a fact that it is perhaps important should be realized and doubtless is realized by investigators over here.

Although the conditions in England are so profoundly different to those in Canada and the United States—quite how profoundly different one must visit the respective countries to appreciate—I will briefly refer to results obtained from our Nationality trials.

COCKSFOOT. Our results bear out those of Lindhard and show that Danish and

United States types are very similar and undoubtedly give rise to some excellent hay strains. French are poor and stemmy, the least persistent and the least desirable. New Zealand are in many respects remarkably similar and contain by far the most leafy strains—whether they are persistent we are not yet prepared to say.

RED CLOVER. Local strains are by far the most persistent and decidedly bulky. Canada and U. S. A. Mammoth are best of the foreign types but samples are inclined to be mixed and variable. France and Chile are generally fairly reliable if only a first harvest year is desired; Chilean are apt to be winter killed in wet cold seasons. Italian are hopeless.

It would take me too far into the realm of surmise to attempt to account for the real and obvious differences that exist in an aggregate strain sense as between Nationality and Nationality—but the *fact* is what matters, for it surely suggests the tremendous possibilities that exist for the improvement of herbage plants.

I have frequently heard it said, by those who I venture to think should know better, that it is almost hopeless to set out to "breed" these cross-fertilizing herbage plants, and the case of maize is cited to show how little chance there is of obtaining virile, selfing strains. The whole point of course is that tremendous improvements can be achieved without attempting to obtain something that is anything approaching genetically pure, and we must expect gradual deterioration from crossing with less desirable strains.

Let us, however, examine the facts. I will first take Cocksfoot (the species upon which I am myself working). I have a living Cocksfoot museum of several thousand plants collected from all parts of England and Wales. Generally if one digs up ten or twenty plants from one field or from a few yards run of hedge, it will be found that these represent several quite distinct growth forms. If, however, plants are taken from a striking habitat, e.g. from the wind swept tops of our Cornish cliffs, my museum shows that all the plants will be to all intents and purposes similar. Thus these plants cross-pollenating amongst themselves have been reduced practically to a unit strain and I should be greatly surprised if under conditions of controlled pollenation they do not continue to do so at Aberystwyth; or if I covered a five acre field with these plants I should produce pure seed of the strain. It is important in this connection to note that most if not all of the strains of Cocksfoot on which I am working flower later than the less desirable ones.

Again it is remarkable how pure in the strain sense are some of our old strains such as the Cornish Red Clovers, although often grown in the close proximity of Broad Reds and ordinary Late Flowering Reds—genetically of course they are utterly impure—having a wide variation in leaf markings and other intimate botanical characters of little significance to the grazier.

As to breeding grasses I feel convinced that good results can be achieved by a system of bunch breeding starting from two or three practically identical plants, although I favour the plan so promising with maize of selfing for a number of generations and then crossing. In this connection it is interesting to note that from all our selfed grasses we are encountering albenoism and kindred phenomena. The great problem as I see it with herbage plants is not so much to breed the strains you want as to decide just what you want, and what precise growth forms will in fact give you what is agronomically desired.

At this stage I am prone to ask, what do we want? In England the war showed us the danger and in a large measure the uselessness of our permanent grass, (please do not think that all or most of our permanent grass is excellent) and I am convinced that really poor permanent grass cannot husband and make for fertility as can excellent temporary grass ploughed down at regular intervals and while the sward is still excellent. It is surely the country which maintains a large area under excellent temporary grass—whether it be in the form of grass and clover mixtures or alfalfa leys—that can face a food crisis with equanimity and can adopt a plough policy at a moment's notice. That was not England's case during the war. In England then our problem is to breed three to five year persistent herbage plants. It is not for me to presume to say what your problem in Canada is but I suppose if the plough is to leave a legacy of fertility behind it, and not to leave land reverting to inferior range and bush, you too want your persistent temporary pasture plants, and this I understand is being

successfully tackled by many of your investigators.

The difficulty then arises when contemplating one's forms— be they Timothy, Cocksfoot or Red Clover—to decide which under pasture conditions will be persistent yet bulky, palatable yet nutritious. It is a formula for helping our choice, criteria upon which to base a sound judgment, that we want and it is along these lines that I feel there is scope for infinite research and for the developing of a very elaborate field technique, but concerning which it would at present be premature for me to offer any suggestions.

I would like to say a few further words on what I deem to be the fundamental obstacles to realization of the ideal of improved herbage plants. I refer to seed production and to safeguarding every district against the use of the seed of herbage and forage plants not suitable to its needs. These are appropriate subjects to consider here today, for I believe they can only be solved by Imperial action.

Let me take as an example the case of our west of England strains of Red Clover, of poor seed quality. If purity of strain means anything, why should you in Canada not receive stock seed of approved strains and grow seed of impeachable quality for us? I would like to see some well planned co-operative experiments conducted on these lines. The same would doubtless apply to Timothy and perhaps New Zealand should be doing the same with Cocksfoot. Then we should not allow seed that is unsuitable to pass from one part of the Empire to another, or from a foreign country into one corner of the Empire to be reshipped to another. We want a close eye kept on the movements of seeds generally, not only from country to country but from district to district.

The Imperial Bureau of Mycology has met with immediate success. Why not an Imperial Bureau of Agriculture? Nothing I believe will bring this need home to us as much as the great impetus everywhere given to crop improvement. The plant breeder needs to comb the world for species and forms. We should at least have the machinery for combing our Empire, for exchanging strains, for trying each other's strains, for growing each other's seeds. A central Bureau would inevitably make for that close co-operation which should surely exist between the growing army of agricultural investigators throughout our Empire.

Marketing and Related Activities in the Bureau of Agricultural Economics of the United States Department of Agriculture

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(Abstract of lecture at the C. S. T. A. Convention)

The development of a study of marketing problems by the Federal Government was begun in the Department of Agriculture because of the close relation between marketing and production. The demands for improvement in the system of marketing farm products came from the producers who desired means of securing a fair price for their products. As the work has progressed it has been found that much of the remedial work falls upon the farmers themselves in the form of adjustment of production to market demands, better grading of product to be shipped, and the proper packing of the product, so that it will arrive upon the market in good condition. The problems of production and marketing are so intimately interwoven that there will be no effort in this brief discussion to separate out the purely marketing functions of the department, but rather to give the marketing work in its setting along with the other economic work of the department.

The rapid development of legislation having to do with marketing and the regulation of marketing agencies, the administration of which has been delegated to the Department of Agriculture, brought about the organization first of an Office of Markets, later expanded into a bureau, then expanded further by consolidation with the statistical and crop-estimating bureau of the department,

and more recently, this year, the organization of all of the activities having to do with the economic side of farm production and distribution into what is now designated the "Bureau of Agricultural Economics."

The history of the development of Government work on marketing problems is comparatively short. While there have been sporadic suggestions since the Federal Department of Agriculture was established, looking toward the development of some marketing agency, nothing of importance was done until March, 1913, when authority was given and an appropriation of $50,000 was made in the Agricultural Appropriation bill for the study of marketing and distribution of farm products by the Department of Agriculture. The Office of Markets was created in May, 1913, as a separate unit in the department. By 1915 an appropriation for this work had been increased to $200,000 and the enforcement of the Cotton Futures Act was intrusted to this office, bringing an additional appropriation of $150,000. Work in rural organization was provided for with $40,000, making in 1916 a total of $484,050 available for marketing activities. In 1917 Congress passed the Grain Standards Act, the Warehouse Act, the Standard Container Act the administration of all being delegated to the Office of Markets and Rural Organization. With the appropriations included for the enforcement of these new acts, the total appropriation for marketing work was increased to $1,172,590.

The war emergency was the occasion for rapidly expanding market service work and when the Bureau of Markets was established under that name, in June, 1918, the regular appropriation of $1,718,575 was supplemented by $2,522,000 for the war emergency work.

In 1921 the consolidation of the Bureau of Crop Estimates and the Bureau of Markets was authorized, thereby providing for a closer correlation of the marketing and production activities. This year, 1922, the Agricultural appropriation bill provided for the consolidation of the Office of Farm Management and Farm Economics with the Bureau of Market and Crop Estimates, which further consolidated production and marketing work into a common field.

Growing Interest in Economic Questions

Uutil the war gave stimulus to popular interest in economic questions, the Department of Agriculture dealt primarily with problems of individual farm management, with particular facts of crop production and with specific market problems. More recently, however, the demand has been for economic information that will enable the farmer to adjust his production program to changed marketing conditions in this country and abroad. Changes in foreign demands, changes in cost of transportation and in charges made for other middleman processes have made it necessary for the farmer to study economic conditions as never before in this generation, if he is to produce and market farm products intelligently.

The development of work in production statistics essential to the adjustment of production to market conditions began with the organization of the United States Department of Agriculture when the work of gathering statistics was inaugurated. Later came a demand for studies of the economic aspects of the individual farm as a basis for efficient farm management, and the organization of the Office of Farm Management resulted. Still later the insistent demand by farmers and the public for a closer study of marketing problems and means of preparing farm products for the market led to the development of the Bureau of Markets. These three phases of the farmer's economic problem were approached from the standpoint of practical results which would be immediately useful to farmers and others, but primarily to farmers. It is the farmer who has the keenest interest in a given consignment of farm products getting into the market. He is interested in efficient handling of his product which will reduce the cost of putting the product upon the market. He is also keenly interested in securing a fair share of the consumer's dollar in return for his productive effort. But since the farmer's future efforts in production are determined by the return he gets, consumers generally are vitally affected by the efficiency and the fairness of the marketing system. Hence, while the marketing of farm products is distinctly an agricultural problem and requires the attention of the agricultural economist, the right solution of these agricultural marketing problems benefits not the farmer only but the whole Nation.

When it became clear to those administering the United States Department of Agriculture that production costs, readjustments in farm organization, the statistics of production, distribution, and consumption, bore

a vital relation to marketing problems and in turn that marketing conditions were determining factors in guiding production, the movement was made to consolidate the divisions of the department dealing with these economic questions into one bureau in order that these allied questions might be handled more efficiently.

The broader scope of the combined bureaus represented in the new group called for a more comprehensive name and the title, "Bureau of Agricultural Economics" was chosen. It is a broad term which covers all the work formerly done by the several bureaus and is also in line with the growing demand from farmers and those dealing in farm products, for world-wide surveys and studies of all the economic factors influencing prices and the movements of products from producer to consumer.

For administrative purposes the work of the economic phases of agriculture, production, and distribution are placed in three general groups of divisions: First, those dealing with production; second, those devoted primilarly to marketing; and, third those dealing with general production and distribution statistics and the other related questions of finance, cooperative organization, land problems, and the larger problems involved in population and rural-life studies.

Divisions of the Bureau of Agricultural Economics

Administrative Divisions

Office of Chief: Associate Chief and Assistants.
- Personnel — Accounts — Supplies —Mails and Files — Photographic,
- Telegraphic, Technological and Stenographic Services.

Division of Information: Publication — News Service — Periodicals.
- Marketgrams — Radiograms — Exhibits — Motion Pictures.

The Economic Library.

Production Divisions

Farm Management:
- Farm Business analysis.
- Farm organization.
- Choice of farms.
- Choice of crops.
- Farm labor.
- Farm power.
- Farm practice.

Cost of Production:
- Crop costs.
- Live-stock costs.
- Costs and management.
- Cost and prices.
- Cost methods.

Crop and Live-stock Estimates.
- Estimates of crop production, stocks, and disposition.
- Estimates of live-stock numbers, sales, and losses.
- Farm prices.
- Prices farmers pay.
- Hours and wages, farm labor.
- Farm statistics.

Cotton:
- Administration Cotton Futures Act.
- Cotton standards.
- Cotton testing.
- Classification.
- Demonstration of classes.
- Handling and warehousing.
- Markets and prices.

Grain:
- Administration Grain Standards Act.
- Standardization.
- Demonstration of standards.
- Milling and baking investigations.
- Grain cleaning.
- Bulk handling and marketing methods.
- Markets and prices.

Fruits and Vegetables:
- Inspection of perishables and containers.
- Administration Standard Container Act.
- Standardization of fruits and vegetables, and containers.
- Market news service.
- Marketing methods and prices.

Hay, Feed and Seeds:
- Standardization of hay and seeds.
- Trade practices.
- Market methods.
- Market news service.
- Seed trade studies.

Dairy and Poultry Products:
- Inspection of dairy and poultry products.
- Standardization.
- Market news service.
- Marketing methods and prices.

Live stock, Meats, and Wool.
- Standardization.
- Market news service.
- Market methods and practices.
- Movements, receipts, and prices.
- Wool statistics.

Warehousing:
- Administration of Warehouse Act.
- Investigations in warehousing cotton, grain, wool, and tobacco.
- Tobacco standardization.

City Markets:
- Administration Washington Center Market.
- Investigation of city market methods.
- Retailing costs and practices.

Cost of Marketing:
- Cost investigations in cooperation with each commodity division on the marketing of various products.

General Divisions

Statistical and Historical Research:
- Trends in production and consumption.
- Price trends.
- Wholesale and retail prices.
- Market movements, stocks and consumption.
- Transportation rates.
- Influences of tariff.

Foreign Competition and Demand:
- Foreign crop reports.
- Methods of production and marketing.
- Consumption requirements.
- New competing countries.
- Trends in foreign competition and demand.
- Tariff influences.

Agricultural Finance:
- Mortgage credit.
- Personal credit.
- Marketing credit.
- Farm taxation.
- Insurance, for production, and marketing.
- Rural public utilities — telephone, light, power.

Agricultural Coooperation:
- Forms of cooperation.
- Methods and practices, etc.

Land Economics:
- Economic classification of land, etc.

Farm Population and Rural Life:
- Analysis of farm population, etc.

SOME OF THE LECTURERS AT THE C. S. T. A. CONVENTION
Left to right: M. O. Malte, Chief Botanist, National Hebraium, Ottawa; R. G. Stapledon, Plant Breeding Station, Aberystwyth, Wales; L. J. Cole, University of Wisconsin, Madison; W A. Wheeler, U. S. Department of Agriculture, Washington; A. Leitch, Ontario Agricultural College, Guelph.

Amelioration de nos Animaux Laitiers

J. A. STE-MARIE,

Station Expérimentale, Ste-Anne-de-la-Pocatière, P. Q.

Celui qui a suivi la marche de l'industrie laitière dans la province de Québec depuis une trentaine d'années, ne peut s'empêcher d'être émerveillé du progrès accompli durant ce laps de temps, dans cette branche de l'Industrie; progrès marquant surtout dans la fabrication, conservation, transport et vente des produits laitiers. Mais d'un autre côté si nous nous arrêtons quelque peu à comparer la qualité des vaches laitières d'il y a 30 ans, à celles que nous possédons aujourd'hui, le résultat n'est pas le même et nous sommes forcés de conclure que notre avancement a été très lent, et cela pour diverses raisons:

1. Tendance atavisme chez les animaux.
2. Ignorance de la part d'un grand nombre de nos cultivateurs des lois de l'élevage.
3. Manque ou connaissance mal appliqué de l'alimentation par nos cultivateurs.
4. Exploitation mal raisonnée chez plusieurs de nos éleveurs.
5. Manque de programme défini chez nos gouvernements pour encourager les éleveurs consciencieux.

Chacune des raisons citées pourraient faire le sujet d'un article, mais permettez-moi de faire une analyse plutôt brève des deux dernières et d'y joindre quelques suggestions.

J'ai dit que plusieurs de nos éleveurs (par éleveurs j'entends ceux qui élèvent et gardent des animaux pur sang) ne raisonnaient pas beaucoup leur exploitation. Nous avons dans la province de Québec 1200 (1) paroisses rurale avec une population de 1,858,981 âmes. D'après la même source de renseignements nous avions en 1920, 1,030,800 vaches. Si nous consultons tous les rapports possibles et faisons la visite d'un grand nombre de beurreries et fromageries où le nombre des vaches alimentant ces fabriques et la quantité de lait apporté est enregistré, nous constatons que la moyenne de production par vache varie de 3,000 à 4,000 livres de lait. Or, que faisons-nous pour relever cette production que nous savons tous trop peu élevée? Nous avons dit et disons aux cultivateurs, donnez une meilleure alimentation à vos animaux; faites de la sélection par le contrôle laitier et ensuite, achetez-vous un reproducteur provenant d'une bonne ascendance laitière. De quelle manière les éleveurs ont-ils répondu à cette demande? Les paroisses où l'on peut compter plus d'une demi douzaine de reproducteurs dont les mères sont enregistrées au Livre d'Or sont si peu nombreuses, que l'on peut les compter sur les doigts de la main. Pourtant, c'est bien l'un des trois facteurs les plus importants d'avoir à la tête du troupeau, un reproducteur dont les qualités laitières sont connues, si l'on désire atteindre un résultat satisfaisant dans l'exploitation d'un troupeau laitier. En plus, est-ce que ce ne serait pas l'avancement même de la cause des éleveurs d'animaux de race pure, que de vendre seulement des sujets dont la valeur est reconnue? Mais hélas, que d'amélioration à faire encore dans cette voie! D'après les livres généalogiques des diverses races d'animaux laitiers, nous aurions dans la province de Québec au delà de 1,600 cultivateurs ayant une ou plusieurs vaches de l'une des cinq races laitières gardées dans la province. Si l'on accorde une moyenne de 8 vaches par cultivateur, cela nous donne approximativement 12,800 vaches de race pure dans la province. Comme plusieurs sont au courant que le moyen de connaître et de déterminer la valeur d'une vache, c'est de la faire concourir au Livre d'Or, ce concours aurait dû être encouragé chez les éleveurs et que voyons-nous? D'après les rapports (2) après déductions faites des vaches qui ont du être vendues à cause de leur âge, d'autres par l'application de l'épreuve à la tuberculine pour l'acréditation des troupeaux, nous sommes d'opinion qu'il n'y a pas plus de 500 à 600 vaches appartenant aux diverses races laitières qui sont enregistrées au Livre d'Or qui vivent. Cela veut aussi dire que nous ne pouvons pas espérer plus de 200 taureaux par année, dont l'on peut connaître la valeur par un record offi-

(1) Annuaire Statistique de Québec 1921

(2) Rapport du Livre d'Or, Département de l'Agriculture, Ottawa, Nos. 1 à 13.

ciel de production de la mère. Vu que ces taureaux, sauves quelques rares exceptions sont vendus à l'âge de 3 ans, cela nous donnerait un taureau, dont nous connaissons un peu ses qualités laitières, par deux paroisses. Est-il surprenant maintenant si nous faisons des progrès très lentement avec nos animaux laitiers?

Nos gouvernements depuis plusieurs années ont dépensé des sommes d'argent assez considérables directement ou indirectement pour venir en aide à l'amélioration de nos animaux laitiers. Mais est-ce que le temps ne serait pas arrivé d'encourager d'une manière plus précise et plus directe nos éleveurs d'animaux de races pures? Au lieu de faire la distribution pratiquement gratuite de sujets reproducteurs ou bien d'accorder des octrois indirects, est-ce qu'un octroi accordé directement au cultivateur qui ferait l'achat d'un reproducteur de race pure dont la mère serait qualifiée au Livre d'Or, ne serait pas de nature à encourager davantage le cultivateur et l'éleveur à développer et à garder des meilleurs reproducteurs?... tout en coûtant moins cher aux gouvernements.

Je termine cet article en espérant que d'autres lecteurs commenteront ces questions qui sont d'un si haut intérêt pour les cultivateurs et l'avancement de l'Industrie laitière de notre province.

Choix, Emploi et Duree des Courroies

Par J. A. SIROIS,

Ste-Anne-de-la-Pocatière, Que.

Les courroies utilisées pour la transmission du pouvoir peuvent être en cuir, en caoutchouc ou en toile.

Les bonnes courroies de cuir doivent durer plus longtemps que toute autre courroie, mais elles semblent coûter plus cher. Leur durée est d'autant plus longue qu'elles sont bien protégées contre la chaleur et l'humidité, qu'elles sont bien entretenues et que les poulies sur lesquelles elles tournent ont le diamètre voulu, sont en alignement et ne sont pas emmanchées de travers sur leur arbre.

On sait que le cuir s'allonge sous l'action de l'humidité, spécialement sous l'action de la vapeur, et qu'il se contracte sous l'action de la dessication; ce qui entraine un fendillement dans sa masse et lui enlève une grande partie de sa résistance.

On emploie quelquefois certaines matières telles que la résine, le sable, etc., pour empêcher le glissement des courroies; ceci n'est pas à conseiller, car l'usage exagéré de ces matières assèche les courroies et les rend cassantes; de plus il provoque l'encrassement des poulies. Il vaut mieux les nettoyer et les enduire de la graisse convenant à la composition de ces courroies, cela les assouplit et si elles ont la largeur voulue pour la force à transmettre, elles ne glisseront pas et dureront plus longtemps.

Certains experts ayant une grande habitude de l'emploi des courroies de cuir recommandent de les entretenir soigneusement en les lavant de temps en temps à l'eau chaude, en les brossant, puis en leur faisant subir un graisage soit à la graisse de pied de boeuf, soit au suif chaud ou encore avec un mélange de deux parties de suif et une partie d'huile de foie de morue. Elles ne doivent être remises en service que complètement sèches. D'une manière générale les huiles minérales ne conviennent pas pour cette opération.

La pratique indique qu'une poulie ne doit pas avoir moins de deux pouces de diamètre et, il est à conseiller qu'elle ne doit pas avoir moins de deux pouces de diamètre pour chaque lui de courroie, c'est-à-dire si la courroie v.g. a trois plis, la poulie doit avoir au moins six pouces de diamètre.

Les poulies doivent aussi être un peu plus larges que les courroies et être légèrement bombées pour que celles-ci se maintiennent mieux sur leur surface. Les courroies ne doivent pas être trop tendues, ce qui a pour effet de nuire à leur durée comme à leur efficacité et de prévenir une bonne lubrication des arbres des poulies.

La vitesse des courroies peut aller jusqu'à un mille à la minute sans qu'il y ait de dangers sérieux. L'alignement absolu des poulies est important, car sans lui, la transmission du pouvoir ne se fait pas aussi bien, la courroie allonge différemment dans sa lar-

geur, la lubrification de l'arbre n'est pas uniforme sur toute la surface qui tourne dans la boîte, ce qui devient une cause de chauffage et d'usure prononcés et graves. Ces derniers inconvénients apparaissent aussi lorsque la poulie est emmanchée de travers sur son arbre.

Les remarques que nous venons de faire sur les conditions où doivent se trouver les poulies, doivent être prises en considération aussi bien lorsque la transmission du pouvoir se fait avec des courroies de caoutchouc et de toile qu'avec des courroies de cuir.

Le caoutchouc de bonne qualité permet de faire des courroies dont la largeur et l'épaisseur ne sont pas exagérées; ces courroies résisteront à un degré de chaleur ou de froid plus élevé que celles de cuir. Leur supériorité se montre surtout dans les lieux humides ou quand elles sont exposées à la vapeur. Les courroies de caoutchouc qui s'adaptent bien aux poulies sont moins aptes au glissement et peuvent être employées avec avantage quand la force à transmettre est très grande. Bien qu'elles ne durent pas aussi longtemps que les courroies de cuir, elles sont assez fortes. Il convient de se servir des liens d'acier pour les lacer.

Les courroies de caoutchouc varient ordinairement de deux à huit plis en épaisseur, et, pour la transmission du pouvoir, l'on admet généralement qu'une courroie de caoutchouc de trois à quatre plis correspond à une courroie de cuir à un pli, qu'une de cinq à six plis à une de deux plis en cuir, qu'une de sept à huit plis à une de trois plis en cuir.

On ne doit pas huiler ou graisser les courroies de caoutchouc.

Les courroies de toile tendent à être employées pour transmettre le pouvoir des moteurs mobiles et à traction. Elles sont très fortes et durables et semblent bien convenir dans le cas de travaux difficiles. Quand elles sont employées en plein air, elles sont ordinairement sans fin. On ne peut conseiller leur emploi dans le cas de poulies fixes, car sous l'action des changements de température, elles tendent à s'allonger ou à se contracter. Ces courroies comme les précédentes, sont d'épaisseur différentes à partir de deux plis en augmentant.

On considère qu'une courroie de toile de quatre plis correspond à une courroie de cuir à un pli.

Nos Connaissances Actuelles sur le Lait

Par M. Louis Bourgoin, Ecole Polytechnique, Montréal.

(Suite du numéro de Juillet)

Le lait renferme des leucocytes qui proviennent du sang et ont passé par diapédèse dans le liquide secrété par la glande mammaire, riche en vaisseaux sanguins. Leur nombre, qui semble plutôt être sous la dépendance d'un facteur individuel, est très variable et peut passer de 4000 à 250.000 et même 1.000.000 chez l'animal sain.

Il va sans dire que, dans les états infectieux de la mamelle surtout, le nombre des leucocytes atteint plusieurs millions, mais cette augmentation n'est pas la caractéristique la plus certaine de diagnostic. Dans tous les états pathologiques de la glande l'harmonie de composition du lait est troublée, elle tend à se rapprocher de celle du sérum sanguin.

Un simple ralentissement même artificiel dans la sécrétion amène une augmentation de la teneur du lait en leucocytes sans qu'on doive conclure à la présence d'un état pathologique. Ces leucocytes ont-ils dans le lait un rôle à jouer? Doit-on les considérer comme utiles, nuisibles ou avec indifférence? Sont-ils solubilisés durant la digestion du lait et apportent-ils comme substances alimentaires les matériaux qui les composent ou restent-ils à l'état de leucocytes pour s'ajouter à l'armée des nôtres alors que les bactéries pathogènes du lait, qui suivent la même voie, seraient déversées dans le torrent circulatoire pour produire la maladie? A ma connaissance aucun auteur ne s'est préoccupé de cette question et on a plutôt pris l'habitude de considérer comme dangereux un lait qui contient beaucoup de leucocytes. N'y aurait-il pas lieu de distinguer entre les laits pathologiques et les laits simplement riches en leucocytes?

Au point de vue microbien, *il n'y a pas de lait absolument septique,* tout au plus peut-on, avec des précautions spéciales, recueillir des laits contenant seulement quelques colonies de bactéries indifférentes. On mentionne parfois que le lait cru a des propriétés bactéricides cette particularité qui serait due à la présence d'alexine dans le lait de vache ne se conserve malheureusement pas longtemps. De plus ces substances sont rapidement détruites par la chaleur aux environs de 60 deg. C (140 deg.).

La mamelle saine héberge des bactéries dont un grand nombre passent dans le lait avant qu'intervienne la contamination durant les manipulations. Le tissu glandulaire est contaminé par le sang, par la lymhe; les bactéries qui s'y trouvent pouvant être saprophytes ou pathogènes suivant l'état de santé de l'animal. En général il s'établit une flore qu'on peut considérer comme normale; on a même été jusqu'à prétendre à l'existence d'organismes symbiotiques[12] vivant normalement dans les tissus.

Une autre cause de contamination de la mamelle vient de l'extérieur jusque dans les gros canaux galatophores par l'orifice du trayon qui est toujours le siège d'une infection locale, entretenue par le séjour d'une petite quantité de lait entre deux traites. Lorsqu'on a soin de rejeter les premiers jets les plus contaminés, le lait renferme encore un certain nombre de bactéries qui pourront se développer dans ce milieu de choix que constitue le lait.

Au cours des états infectieux, les microbes qui les déterminent passent dans le lait. Ceux qui peuvent transmettre leur virulence à l'homme sont, dans l'ordre croissant de leur importance: les trypanosomes pour le lait humain — le virvus de la variole (*cow-pox* ou vaccine) le micrococçus mélitensis de la fièvrve ondulante — le bacille du charbon — le virus inconnu de la fièvre aphteuse — les bacilles enteriditis et coli présents dans les mammites — enfin et surtout le bacille tuberculeux.

Malgré un grand nombre d'expériences contradictoires, il semble raisonnable d'admettre aujourd'hui[13] que le bacille tuberculeux type bovin, qui se différencie par certains caractères du type humain, est capable, bien que moins virulent, de produire par ingestion répétée des lésions tuberculeuses particulièrement sur les organismes jeunes en état de moindre résistance et chez qui une perméabilité relativement grande de la muqueuse intestinale permet le passage du bacille dans l esystème circulatoire.

Un auteur, Behring, à voulu accuser le lait d'être la source principale de contamination tuberculeuse. A. Calmette, dans son magistral et récent traité sur "l'infection bacillaire et la tuberculose" écrit ceci: "Si l'on établit une comparaison entre le nombre souvent énorme d'échantillons de laits du commerce que l'on trouve infectés de bacilles tuberculeux dans les grandes villes (environ 10 p.c.) et la proportion des cas d'infection humaine d'origine sûrement ou probablement bovine, on est obligé de reconnaître que la consommation de ces laits est loin d'être aussi périlleuse qu'on eût pu le craindre." Kitasato constate que la tuberculose infantile est fréquente au Japon alors que les enfants ne sont jamais nourris au lait de vache. Speak au Groenland fait la même constatation alors qu'il n'existe pas de vaches dans la région. En Sardaigne une enquête conclut à la fréquence de la tuberculose chez l'homme et à sa rareté chez les bovins.

L'opinion de Berhing est donc exagérée, celle de Kock qui formule l'innocuité pour l'homme de la tuberculose bovine est aussi inexacte puisqu'il y a des cas certains de transmission de la tuberculose bovine à l'enfant. On ne peut nier son existence, mais les auteurs récents senblent en accord sur ce point qu'il faudrait pour produire à coup sûr l'infection, des quantités considérables de bacilles virulents.

Il est donc sage de ne pas exagérer les dangers du lait des vaches ayant réagi à la tuberculine, mais il est bon de prendre des mesures de prudence efficaces quand il est nécessaire. La grande question, très controversée actuellement, est de savoir *quand* le lait contient du bacille tuberculeux virulent. Tout animal ayant donné une réaction à la tuberculine donne-t-il un lait contaminé? N'oublions pas que cette réaction est d'autant plus nette et accentuée que la lésion est plus minime et cachée. Si on se souvient du fait que la grande majorité des expériences d'infectiosité du lait d'animaux ayant réagi ont été faites *par inaculation* au cobaye d'un culot de centrifugation du liquide et non par

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12 J. Portier: *Les Symbiotes.* (Paris 1918.)

13 H. Vallée et Panisset: *Les tuberculoses animales* (1920) A. Calmette: *L'infection bacillaire et la tuberculose chez l'homme et chez les animaux* (1920.)

ingestion, on doit admettre que la preuve est mal faite quant aux dangers d'infection par voie digestive. On est plus près de la vérité en admettant, avec certains, qu'il faut une lésion mammaire avancée ou un foyer de tuberculose ouvert apportant dans le lait un nombre considérable de bacilles qui passeront dans l'estomac où ils ne pourront pas tous être détruits par la pepsine chlorhydrique, pour déterminer à coup sûr l'infection par voie digestive. Heureusement la bacille tuberculeux ne se multiplie pas dans le lait, même à 30 deg. C. Mentionnons ici une autre cause d'infection du lait qui, si celui-ci n'est pas mélangé à une grande quantité de bon lait, peut être dangereuse; l'infection par les matières excrémentielles d'animaux tuberculeux.

Pour ma part, j'estime que sur cette question beaucoup d'expériences sur la tuberculose humaine et bovine mériteraient d'être reprises et complétées dans les Instituts de recherches. C'est une question au moins aussi importante pour une nation que l'entretien de représentants commerciaux par les gouvernements dans les pays étrangers.

En plus de la contamination originelle du lait, il en existe une autre; celle des manipulations que nous faisons subir au lait avant de le consommer. Ne prenant que celle pendant la traite nous voyons qu'elle dépend: 1° de l'état de propreté des trayons et de l'animal, 2° de la propreté des mains du trayeur ou des appareils à traire, 3° de la contamination des récipients et appareils servant à recueillir le lait, 4° des poussières de l'étable et du milieu ambiant, 5° de la chute de matières excrémentielles dans le liquide, 6° de la propreté du lieu et de la température de conservation du lait trait.

C'est sur ces points qu'avec juste raison, les hygiénistes portent leurs efforts. Les apports microbiens peuvent être coséquents puisque le lait est un milieu propice à la vie et au développement d'un très grand nombre d'espèces.

Le choléra, la scarlatine, la diphtérie, la typhoïde peuvent être transmis à l'homme par le lait contaminé à partir de la traite et, si nous ne pouvons nous étendre sur cette intéressante question de la flore totale du lait, nous dirons simplement qu'elle se divise en deux groupes bien distincts: la flore nuisible et la flore utile qui est trop souvent méconnue.

De tous les laits, le lait de femme est celui qui échappe en grande partie à la contamination de la traite. Il est toujours le moins contaminé, il est le seul fourni à l'enfant pour qui il est fait, sous la forme la plus indemme de modifications accidentelles indésirables.

A propos des constituants du lait je n'ai pas à parler des éléments apportés accidentellement par les médicaments ou certains aliments spéciaux, non plus que des variations en somme petites de sa composition sous l'influence de divers facteurs du régime de vie.

RECTIFICATION

Une grave erreur d'impression s'est glissée dans le rapport français de la Convention annuelle publié dans le numéro de juillet. A la page 376, deuxième colonne, deuxième paragraphe, cinquième ligne, on doit lire: "parce que l'agriculture a pour but immédiat, des préoccupations d'ordre pratique" au lieu de "préoccupations d'ordre politique."

NOUVELLES

C'est avec un réel plaisir et une fierté bien légitime que les techniciens agricoles ont vu l'un de leurs membres, M. Geo. Bouchard, franchir l'enceinte parlementaire et devenir membre de la Chambre des Communes à Ottawa, représentant une circonscription agricole de la Province de Québec.

Professeur distingué, agronome dévoué, M. Geo. Bouchard saura toujours faire profiter la classe agricole de l'énergie et des talents dont ils ont toujours fait preuve, porterait les techniciens lui souhaitent plein succès dans l'accomplissement de ses nouvelles fonctions.

M. Albert Gosselin, B.S.A., ex-assistant rédacteur du *Bulletin des Agriculteurs*, est entré au service de la Division des Semences pour la province de Québec. Nous lui souhaitons plein succès dans cette nouvelle position.

Diseases of the Potato

by B. T. DICKSON,
Professor of Botany, Macdonald College.

(Continued)

GROUP 8. "PHYSIOLOGICAL" DISEASES.

(a) Black Heart

As the name indicates the symptoms of black heart are confined usually to the medullary region. The blackened tissues are irregular in outline and almost always elongated from stem to bud and with branches extending towards the buds. Occasionally there may be large black spots scattered irregularly through the flesh of the tuber and sometimes the vascular tissues are blackened. Surface discoloration of the tuber occurs in cases of insufficient aeration but usually no surface symptoms are evident.

There are two conditions which bring about black heart. The first is overheating and this is a shipping trouble. Among potatoes shipped during the winter in stove-heated cars those in the vicinity of the stove are frequently found to be badly affected with black heart. The experiments of Bartholomew in 1913 showed that heating tubers to 100-113° F. for 14-18 hours brought about changes in the respiration rate of the tubers so that in the overheated environment more oxygen is demanded than is available. The innermost tissues are the first to be affected by the insufficient oxygenation and they become necrotic and brown to black in colour. Gradually the dead cells dry out becoming shrunken, tough and black.

The second condition was demonstrated by Stewart and Mix at the N. Y. Geneva Station. They showed that black heart occurs at low temperatures if the oxygen supply is markedly deficient. Tubers confined with a volume of air equal to the volume of potatoes required up to 40 days for black heart to develop at 40°F.

Whether affected tubers sprout or not depends upon the extent of the collapsed tissues and upon whether the injury is due to insufficient oxygenation at high or low temperatures. Usually the latter require a longer time for sprouting but if no surface injury is present and the buds sprout well there is no harm in using such tubers for seed. It is obviously unwise to use tubers with surface lesions for seed since the lesions will become breeding grounds for fungi and bacteria.

Control

It must be remembered that potatoes stored at high temperatures and for a long period require more ventilation than those stored at lower temperatures or for short periods.

1. Potatoes should not be stored more than six feet in depth at temperatures below 45°F. for a lengthy period of time. At temperatures of 50° F. to 70°F. they should not be piled more than 3 ft. deep if they are to be kept longer than a month.

2. Small potato pits do not need extra ventilation but the tubers should be protected from frost.

(b) Frost Necrosis

In Canada, as in the northern tier of states of our neighbour, the main crop is in constant danger of exposure to freezing temperatures from the time of harvest to planting or to retail sale. There are two types of frost injury, viz:—that in which complete freezing occurs and that in which no superficial symptoms are noticeable. In the first case freezing is due to exposure to a very low temperature or to prolonged freezing at a somewhat higher temperature. The tubers are frozen solid and the tissues collapse on thawing. The soft, wet condition resulting is easily recognized.

The second type is due to exposure to temperatures just below the freezing point or to a very low temperature for a short time. In this case, the tuber is never frozen completely but certain tissues only are affected. Upon exposure to ordinary storage temperatures the affected tissues become necrotic and are blackish in colour after being exposed to oxidation in the air. The necrosis is of three general types, viz. net, ring, and blotch.

In "net" necrosis there is a general blackening of the finer vascular elements extending from the vascular ring into the medulla and cortex.

A more pronounced blackening in the vascular ring and adjacent tissues gives the "ring" type of frost necrosis. This is often most apparent at the stem end.

When the necrotic areas are larger and less

defined we have the "blotch" type and this is often found in the cortical tissues.

Frost injury before or during harvest may give rise to any of these types or modifications of them but as a rule the ring type predominates if exposure is short since vascular tissues are more sensitive than parenchymatous, while the blotch type is common with long exposures to chilling temperatures.

(c) Net Necrosis or Vascular Discoloration

In discussing Leafroll, Fusariose, and Frost necrosis it was pointed out that the term "net-necrosis" is applicable to any of these tuber troubles if the delicate vascular network is discolored. In discussing vascular discoloration Edson in 1920 says, "A popular impression has prevailed that any except the most superficial stem-end discoloration might be taken as a trustworthy indication of the presence of Fusarium, or, at least, that the stock was grown on vines affected with Fusarium or Verticillium. Somewhat extensive preliminary observations and cultural studies, made by the writer both at the time of harvest and during or at the close of the rest period, on stock grown in sections where Fusarium blight and wilt do not occur, as well as in sections where they are known to be general, show that, while Fusarium and Verticillium undoubtedly do cause vascular discoloration of potato tubers, discoloration can not be accepted as proof of the presence of Fusarium or, indeed, of any other organism, nor can the absence of discoloration be confidently accepted as proof of the sterility of the vessels near the stolon attachment. There seems to be reason to think that vascular necrosis may often arise from purely physiological causes and that it need not necessarily be seriously abnormal, though frequently it is."

This author found that out of 3,042 plantings from discolored tissues 1,352 gave no growth.

(d) Internal Brown Spot

In this disease brown spots are scattered through the flesh of the tuber and are not confined to the vascular ring. The spots consist of dead brown cells surrounded in many cases by cork cells. It is possibly something like stippen in apples and is associated with unfavourable soil moisture conditions at a critical period in the growth of the tuber.

(e) Spindling Sprout

Weak spindling sprouts are likely to develop from tubers affected by mosaic, leafroll, fusarium necrosis, etc. and in all instances such weaklings are best eliminated from the crop. It is also found that potatoes grown under unfavourable soil or climatic conditions tend to give rise to spindling sprouts when used for seed. Similarly the same strains grown year after year will gradually lose vigour and "run out" resulting in weak progeny. It is advisable to sprout potatoes before planting and to discard those with thin, straggling, spindling sprouts.

(f) Hollow Heart

This condition occurs as a result of the too rapid growth of the tubers. Some varieties, such as the Rural New Yorker, when grown in rich soil frequently develop hollow heart. The tissues surrounding the irregular space in the heart of the tuber are brown and lined with a corky layer. The trouble is not serious from a pathological point of view.

(g) Arsenical Injury

This is not serious when ordinary precautions are observed. Arsenic oxide is the base of any arsenical spray used in controlling chewing insects and its use alone would cause severe burning to the foliage. It is therefore necessary to use it in a combined form such as Paris green, lead arsenate, calcium arsenate, etc. The arsenate is better used in combination with Bordeaux so that sufficient lime is present to prevent burning of the foliage. Burning occurs where insects have made injuries and in the axils and margins of leaves where the insecticide is likely to be held in quantity. The use of a finer spray from high pressure nozzles will usually prevent such accumulations of material on the plant.

GENERAL CONSIDERATIONS IN CONTROL.

1. Control of potato diseases by the grower involves as a first essential that the grower know the diseases which have to be controlled. Every grower of potatoes on a large scale ought to familiarize himself with symtoms and with the major points in the life history of the causal organism if such exists. To do the right thing at the correct time necessitates accurate knowledge. Information can always be obtained from Macdonald College in Quebec, from the Ontario Agricultural College in Ontario, from other agricultural colleges throughout the Dominion

and also from Provincial and Dominion Departments of Agriculture. No grower need lack technical help to-day in this respect.

2. Next to a knowledge of the diseases to be controlled and how to control them the most important point is to know thoroughly the variety or varieties most suitable for the locality and the market. It is best to grow only one or two varieties and to know these so that "off varieties" can easily be detected and rogued from the seed plot. Grow a seed plot every year and select hills for freedom from disease and for yield and type. In arranging the seed plot choose clean land, prepare it well, practise deep plowing and rotation with legumes and cultivate the potatoes thoroughly.

3. As to the seed tubers themselves the selection of thoroughly clean, sound tubers is a prime requisite. Too many growers still plant scab, black leg, blight, etc. and expect to get potatoes. If it is impossible to obtain first class, clean seed the next best thing is to treat what is available.

4. For seed tuber treatment two chemicals are available:—mercury bichloride which is a deadly poison and formaldehyde which is also a poison but which warns one by the gas given off.

Mercury Bichloride or Corrosive Sublimate Treatment

Soak the seed tubers in a solution made of 4 ozs. of mercury bichloride in 30 gallons of water for half an hour. If Black scurf is present treatment for a longer period is advisable according to the work of Howitt at Guelph (see p. 236). The addition of one ounce of mercury bichloride to the 30 gallons of water after each sack has been treated will keep the solution up to strength. If larger quantities are to be treated vats should be used so that the tubers can be handled in crates. It is important to remember that with corrosive sublimate (mercury bichloride) no metal vessels can be used. Treated tubers are poisonous to stock and man. The corrosive sublimate can first be dissolved in 2 gallons of hot water and added to 28 gallons of cold since it is not easily soluble in cold water.

Formaldehyde Treatment

1. Soak seed tubers for 15 minutes in a solution of formaldehyde made by adding 1 pint (or 1 lb.) of concentrated formaldehyde (commercial or 40 per cent.) to 30 gallons of water.

2. A method recently tested by Melhus is recommended if the grower can arrange a tank in which formaldehyde solution of double the above strength is heated to 118° to 122°F. In this case the tubers are soaked for two minutes at this temperature and then covered for an hour before cutting.

5. If it is not convenient to plant immediately after the completion of seed tuber treatment, care must be taken that the treated tubers are not placed in sacks or containers which have not been disinfected.

6. When cutting the tubers discard all rotted stock and also those tubers showing browning or blackening in the vascular ring at the stem end. It may happen that the discarded tuber would give a healthy plant but the chances are against it and "safety first" is a wise saw.

7. During tho growing season give the plants good cultivation.

8. Spray thoroughly with Bordeaux mixture from the time the plants are eight inches high. Make the applications about every two weeks depending upon the weather. If the weather is moist and warm and plants are developing new leaves very rapidly they must be covered with spray and hence spraying may have to be done every ten days and perhaps later during a drier spell at longer intervals like 2½ weeks. Spray before a wet spell and use a fine spray which will cover *both* sides of the leaves. Dusting is as good as spraying for potatoes in most localities. To control potato-chewing insects it is necessary to add calcium arsenate or lead arsenate to the spray or dust. It is not necessary here to deal with the preparation of Bordeaux mixture or dust but any grower desiring information will be gladly accommodated if he will write to Macdonald College.

9. Finally greater care must be taken in harvesting, handling and storing potatoes. It is unfortunate that an excellent yield is sometimes spoiled in its last stages by bad handling.

NOTES

E. G. Hood (O.A.C. '13) Lecturer in Bacteriology at Macdonald College, has recently received the degree of Doctor of Philosophy from the Massachusetts Agricultural College.

Dr. G. P. McRostie (O.A.C. '12 Cornell '20). Associate Professor of Cereal Husbandry at Macdonald College, has been appointed Dominion Agrostologist at the Central Experimental Farm, Ottawa.

Concerning the C.S.T.A. and Its Branches

BY THE GENERAL-SECRETARY

THE NEW PREMIER OF MANITOBA

President John Bracken of the Manitoba Agricultural College, Winnipeg, and formerly Professor of Field Husbandry at the University of Saskatchewan, is to be the next Premier and Prime Minister of Manitoba. Announcement of his selection and acceptance was made on July 21st.

John Bracken is a native of Ontario, is 39 years of age, graduated from the Ontario Agricultural College in 1906 and

has been President of the Manitoba Agricultural College since June, 1920. In that position he succeeded J. B. Reynolds on the latter's appointment as President of the Ontario Agricultural College.

During the year 1921-22, John Bracken was Vice-President of the Canadian Society of Technical Agriculturists. He has been a member since May, 1920, when the Society was in process of organization.

Our warmest congratulations are extended to Premier Bracken, a man who has already done much for agriculture in western Canada.

IMPORTANT ANNOUNCEMENT

On August 1st, 1922, immediately after the publication of this issue, the headquarters of the Canadian Society of Technical Agriculturists are being moved to Ottawa. This is merely a return to the city where the Society was organized during the early part of 1920 and where its headquarters remained until October of that year. At that time a transfer to Gardenvale, P. Q., was made necessary because of the fact that the offices of the Industrial and Educational Publishing Company (the original publishers of "Scientific Agriculture") were located there.

Since July, 1921, the Society has owned and published "Scientific Agriculture" and the Dominion Executive Committee at the close of the recent annual Convention. decided in favor of returning to Ottawa.

The new address for all correspondence in connection with the Soiety or "Scientific Agriculture" is:

P. O. Box 625, Ottawa, Ontario.

Future issues of "Scientific Agriculture" will be published by the Society at Ottawa.

ADVANCED LECTURES

In this issue it has not been possible to publish all of the lectures given at the Convention of the C. S. T. A.; complete manuscript has not been received. We have, however, included in this issue abstracts of four lectures given by Professor W. T. Jackman, two lectures by Dr. A. B. Macallum, one lecture by Professor R. G. Stapledon and one lecture by Professor W. A. Wheeler. The lectures by Dr. M. O. Malte, Dr. L. J. Cole and Professor A. Leitch will appear in later issues.

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